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The Jubilee Memorial Lectures

THE Jubilee Memorial Lecture of the Society of Chemical Industry is one of those interesting and curious survivals of the circus, a touring show that goes from place to place without ever having its doings reported in the Press until the last show is over and the curtain has descended for the last time. The lecture is repeated several times up and down the country. The idea is good because in many societies the complaint is heard that those in London get all the fun whilst the poor provincials have to put up with whatever they can get. The idea of travelling lectures is nevertheless not capable of too great extension. For many reasons the written word carries less conviction than the spoken word, but the written word can be read at leisure and digested quietly in the still watches of the night, whilst the spoken word floats away on the air and is lost for ever, save in so far as it lingers on awhile in the minds of those with good memories. How often have readers in attending lectures found themselves interested in a train of thought that has been awakened by some remark made by the lecturer with the result that when, a little later on, they have come to earth—alas much of the lecture has gone by on unheeding ears.

How often again after a day's work, have we unaccountably nodded during a lecture and have awakened with a start to find that the thread of the discourse has been irrevocably lost. The good lecturer comes prepared with his subject-matter, but does not read his discourse. Frequently he wanders along delightful sidetracks—and the lecture as printed sticks only to the broad highway. The Jubilee Memorial lectures are a law unto themselves, and rightly so, but the principle of delivering abstruse scientific discourses in the form of lectures is not best suited to most subjects. The ideal method, a method that is not apparently favoured by the Society of Chemical Industry at any of its meetings, is to print the paper in advance, thereby allowing the author to wander at will and with as short a discourse as he may desire, and giving the audience every opportunity of preparing a goodly selection of those damaging remarks that so enliven scientific meetings.

A second thought that is suggested by these reflections is that granting the desirability of spreading knowledge in certain directions by the spoken word it is necessary that adequate provision should be made for the audience. The audience should not be made too comfortable—but there is no likelihood of that happening; lecture rooms are not yet equipped like picture theatres. On the other hand it is surely desirable that sufficient room should be available for the audience and that the room should be adequately ventilated. Neither of these conditions is customarily fulfilled at the Memorial Lectures in London. The lecture room of the Chemical Society, whilst just—and only just—large enough for most meetings of the Society of Chemical Industry and most of the other bodies that borrow it, is inadequate for the Memorial lectures, and upon the occasion of Professor Heilbron's discourse, and equally on the previous occasion in 1934, members were standing, some of them outside the room and unable to see the lecturer. In other respects the Chemical Society's rooms are not thoroughly laid out for the reception of a large gathering. The need for a proper home for chemists becomes more evident with each passing year. Failing that promised land, is there any fundamental reason why chemists should not at times seek the hospitality of engineers. The Institution of Mechanical Engineers, for example, has a beautifully equipped lecture room, and so have the Civils and the Electricals. The Institution of Gas Engineers and the Institute of Fuel, to mention only two bodies, have borrowed both these rooms on occasion.

A third thought that the Memorial Lectures suggest is the intense interest and value of the work that is here put before us. The lecturers, as Professor Heilbron did this year and Professor Hilditch last year, describe researches that may not be of any immediate value to industry. Some day one or another branch of the chemical industry will no doubt benefit, but that time is not yet. Meanwhile researches such as these, which will be of the utmost value to the human race, not in any narrow industrial sense but in bringing improved health, greater happiness and longer life to mankind, are carried on by individuals all too frequently unsupported by outside assistance. Professor Heilbron's description of the wonderful work that is being done on what he aptly describes as the "Chemical Elixirs of Life," seems to suggest that the most fundamental processes of life itself will soon be laid bare by the chemist and the physiologist. This is work as important as that being done by any of our industrial research organisations; they are concerned necessarily with the economic welfare of an industry; these fundamental researches affect the well-being of the whole human race. What provision is made to enable this strikingly difficult work to proceed quickly and satisfactorily, and not to be conducted only because the enthusiasm of a few devoted pioneers renders it possible? Has not the time come to visualise subsidising nationally research that is not designed to fulfill any immediate utilitarian ends, but that has potentialities of immense range sociologically. What provision do we make as a nation for *pure* scientific research?

Notes and Comments

The Election and After

THERE was no mistaking the sigh of relief which went up from the business community when the result of the General Election was known. Neither a technical journal nor the constituency it serves has affiliations with any political party. Both, however, are deeply concerned with the type of Government under which they will render their special forms of public service during the next few years. Faced with a choice between a broad-based and experienced Government and an Opposition committed to revolutionary experiments, the nation has pronounced for the former with unexpected fervour. The business community is entitled to rejoice in a result to which it undoubtedly made an important contribution. Nothing has been more striking than the impression made by the result of the election on foreign opinion. Responsible commentators in all parts of the world have remarked on the extraordinary steadiness of the British electorate at a time of universal strain and difficulty.

This steadfast attitude has excited the admiration of the world, and is accepted as affirming the determination of Great Britain to complete the post-war task of putting its house in order in accordance with the democratic and economic principles which it has inherited from former generations. Nothing now remains but to get on with the job. The nature of the job is not in doubt. Trade must be brought back to its former level and employment must be secured in its pre-war volume. The last official returns under both these heads, and especially in the region of foreign trade, were definitely encouraging. All through this year some of the lost ground has been made up month by month, notwithstanding the disturbing element of an early General Election. Until the polls were declared last week, manufacturers and traders could not feel certain that their business operations would not be subject to serious Government interference within a measurable period of time. There was a marked slowing down in the making of long-period contracts, together with a tendency to keep stocks as small as possible. The fears which inspired this caution in the business world have now been dispelled. The nation has sounded a new note of confidence, which is the only true begetter of better business. The business world is entering upon a four or five years period which promises at the end a far healthier state of society than this country has enjoyed for nearly a quarter of a century.

Overseas Chemical Trade

CONTINUED progress in the chemical industry is revealed by the Board of Trade Returns for October, which show a total export of £1,997,140 worth of chemicals, drugs, dyes and colours during the month, against £1,798,007 in the same month last year, and £1,661,670 in October, 1933. The totals for the ten months ended October 31 also show that in spite of monthly fluctuations a steady advance has been maintained throughout the year, the figures for 1935 being £16,849,417, against £16,273,824 for the corresponding ten months of 1934 and £15,291,300 to the end of October, 1933.

Since the returns have included information as to the destination of British exports it has been of interest to observe that India is easily the largest customer of the British chemical industry, having taken £2,164,486 worth of British products this year. Australia is the next best with a total of £1,406,015, and South Africa is third with £1,154,600. Canada has taken just under a million pounds worth of British chemicals this year, her total to date being £979,408. The United Kingdom has this year exported £1,310,449 worth of ammonium compounds, of which £249,193 have gone to India, £129,815 to Portugal and £127,842 to Spain. Sodium chlorate exports have amounted to £575,963, of which £174,655 went to British West Africa. Of our total exports of £862,159 worth of sodium carbonate, British India has taken £202,372 and Australia £105,501. Caustic soda exports have amounted to £1,009,578, of which India's textile trade has taken £141,570, while Brazil has taken £202,449. India has also taken the largest share of United Kingdom exports of proprietary medicines. Total exports to date this year have been £1,017,507, and India's share has been £160,389, South Africa coming second with £112,717.

Statistical Methods and Standardisation

MODERN industry is awakening to the value of statistical analysis in the control and standardisation of quality in industrial production. Methods which have been developed to deal with problems of the biologist and agricultural experimentalist are being recognised as being directly applicable to industrial problems also. It is impossible to achieve exact "sameness" in reproduction, whether it be measured by linear dimensions, tensile strength, electrical resistance or any other method. In all cases the recorded measurements will not be found identical; the differences are not always due to errors in measurement but exist in the things themselves. This variation calls for the employment of statistical methods in assessing the quality of a consignment of material from tests performed on only a portion of the consignment, particularly so when economic considerations limit the number of tests carried out. It is then of major importance to turn to the best account the information provided by these tests.

How is the manufacturer, who takes tests at regular intervals, to judge from these tests whether the technical processes of manufacture are remaining under proper control? How is the consumer to determine that the material he buys complies with the tests laid down in clauses of a specification? These questions are dealt with in a publication issued by the British Standards Institution, written by Professor E. S. Pearson, of the Department of Applied Statistics University College, London, in co-operation with a committee of men engaged in practical industry. The main object of the publication is to set out as clearly as possible for the industrialist no less than for the statistician why statistical technique is needed and what kind of assistance it can give. Illustrations have been taken from the manufacture of cloth, of electric lamps, of building materials; and from the testing of coal and engineering products, etc.

Modernising the Steam Boiler Plant

By DAVID BROWNLIE

A LARGE number of industrial steam boiler plants, including those of chemical works, are still being operated on crude and rule-of-thumb lines in spite of the general improvement that has taken place in this field during recent years.

The only proper scientific method of operating a boiler plant, even of relatively small size, is to regard it as a chemical plant which requires careful weighing and analysis of the ingredients used (coal and water), accurate scientific control at every stage of the operation, and measurement of the yield (steam). This is quite apart from the different and equally important aspect of the provision of efficient plant and equipment, including methods of firing and burning the coal, sufficient draught, adequate flue areas, non-leaky brickwork, and accessories such as feed-water economisers, superheaters, and if necessary air heaters and water softening plant.

It is quite impossible, however, to obtain efficient results with perfect equipment unless adequate methods of scientific control are adopted. In the operation of any boiler plant, even when burning only a few tons of coal per week, two items are essential. In the first place it is essential to keep a continuous record of the weight of the coal (or other fuel) burnt and of the steam produced, either in the form of the water evaporated or of the actual steam itself, using steam meters. Secondly, the heating value of the coal should be determined from time to time, so as to enable the gross thermal efficiency to be worked out. The adoption of these relatively simple methods alone would result in a great improvement in the large majority of plants that are still operating in blissful ignorance of the performance except as regards the actual total weight of the coal burnt, which is known merely because the purchaser receives invoices from the coal seller.

Coal Weighing Machines

For the medium and large-sized industrial boiler plant there are about half-a-dozen firms in Great Britain who supply high-grade automatic coal weighing machines which give continuous records of the coal burnt. Several general principles of design are adopted, including the use of small balanced weighing tanks or containers into which the coal flows continuously, and is discharged again when the standard weight is reached, followed by re-filling, and so on, the necessary mechanism, including the recording of the weight, being brought into action automatically. Other methods in use are the continuous measurement of the thickness of a coal layer on a travelling surface and the velocity of coal passing along a chute, pipe, or ram cylinder of standard dimensions.

With regard to the measurement of the water evaporated, from 15 to 20 British firms manufacture hot water boiler feed meters, representing a number of different principles. For example, there is the closed pressure type of meter placed in the feed circuit, whereby a piston or other moving displacer is operated in conjunction with a train of wheels and a series of dials, giving the volume direct. There is also the "Venturi" tube and the similar disc method, which under proper conditions is both convenient and accurate, while on these general lines also is the " Pitot " tube principle. Again a number of feed meters are of the "V" notch or weir type, and in addition there are water weighing machines with balanced tanks, on the same lines as coal weighers. The steam user, therefore, has ample choice of convenient and efficient boiler feed meters, most of which can easily be installed under such conditions that they can be tested rapidly for accuracy at any time by means of a large tank of known volume. In general, the small tank method of measuring boiler feed water by weighing on a separate weighing machine can now be regarded as obsolete, although it can always be used as a check for any special test. Some of the displacement meters available are of a convenient type for small boiler plant, being fixed in the feed pipe circuit and occupying little room, while the necessary temperature corrections for expression as weight of water are very simple.

For determining the heating value of coal, necessary to calculate the gross thermal efficiency, as stated, the standard method is the oxygen bomb calorimeter, and methods for the chemical analysis of coal in the shape of determination of the fixed carbon, volatile matter, ash, and moisture, are already familiar to chemists.

Determination of Carbon Dioxide Content

In the case of almost all boiler plants burning from, say, 10 to 20 tons of coal a week or over, it is essential to operate with a combustion recorder, that is to carry out automatically a determination of the CO_2 content of the flue gases in order to prevent losses due either to excess air, with low CO_2 content, say, below 10 per cent., or a deficiency of air, with the escape of CO and unburnt products. Here again from 15 to 20 firms make combustion recorders, which have been on the market since about 1900, although they have only come into relatively wide use, say, in the past 10 years.

One of the chief general principles used in combustion recorders is the absorption of the carbon dioxide by means of caustic potash, a measured volume of the combustion gas being bubbled through the solution and the reduction in volume measured and recorded with a pen and clock mechanism direct as percentage of carbon dioxide. Another method employed also depends upon the fact that carbon dioxide is heavier than air, so that by continuously weighing air in comparison with combustion gas the difference in weight can be used as a measure of the percentage of carbon dioxide. Equally interesting is the electrical method, consisting in the measurement of the difference in the amount of heat radiated from standard coils of incandescent wire in air and in combustion gas containing carbon dioxide and therefore the electrical conductivity of the coils. Combustion recorders give the percentage of carbon dioxide either as a continuous curve or at the rate of, say, 20 analyses per hour using a pen and chart operated by clockwork.

For large boiler plants important instruments are combined CO_2 and either CO_2 or oxygen recorders, which give a still more complete check on the efficiency of the combustion. Thus, for example, carbon monoxide and unburnt products are determined by passing alternate samples of the flue gas first through a copper gauze heated electrically, which burns the products and increases the CO_2 as compared with the percentage of CO_2 in the ordinary sample, thus giving a measurement of the unburnt products. In most industrial plants the trouble is excess of air and low CO_2, but if by any chance there tends to be any deficiency of air, with the presence of unburnt products, the loss of efficiency is extremely serious, much more so than in the case of excess air. It is also a good policy in many cases to take a continuous sample of the flue gas in a large container for laboratory analysis by means of the " Orsat " or other apparatus.

Detailed Boiler Plant Tests

During the past few years one is glad to note that some extremely detailed boiler plant tests have been carried out, especially so far as complete chemical analysis of the flue gases is concerned. One of the most elaborate series of tests ever undertaken was that by P. H. Hardie and W. S. Cooper, of the Brooklyn Edison Co., Inc., New York, in connection with the test performance of one large water tube boiler at the Hudson Avenue power station, the results being given in a paper read in December, 1934, before the American Society

of Mechanical Engineers. There were determined in these tubes not only the usual figures regarding steam generation performance but in addition items such as the amount of moisture in the steam, combustible in the ash and clinker, and dust in the combustion gases, as well as the determination not only of carbon dioxide, carbon monoxide, and oxygen in the flue gases, but also the unburnt hydrogen and hydrocarbons. As a result the "unaccounted for" losses in the heat balance sheet were reduced for the first time to an almost negligible figure, not much more than 1 per cent. of the total heat of the coal.

The steam meter is of the utmost importance for the control of steam boiler plant, quite apart from its great value in connection with the recording of the amount of steam used in different departments and processes of chemical works or other industrial establishments. A number of high-grade steam meters are available, most of which depend upon the orifice or disc principle, that is essentially, as already stated, a modified "Venturi" tube. They differ amongst themselves chiefly as regards the methods used for recording continuously, in terms of pounds of steam per hour, the extremely small difference in pressure caused by the restriction in the steam flow resulting from the orifice, with automatic compensation also for varying steam pressures.

Apart from measuring the total output of steam from a boiler plant, or from individual boilers, as an alternative to feed meters, the great value of the steam meter is that a continuous record can be obtained of the auxiliary steam used in the boiler house. It is almost incredible that at the present time even most power stations do not adopt scientific methods for recording this auxiliary steam, which may vary from, say, 1 per cent. to 5 per cent. of the total production. In industrial plants 5 per cent. to 10 per cent. of the total steam is often used in this way, and there are authenticated cases of fantastic figures such as 15 per cent. to 20 per cent., especially when obsolete types of steam jet appliances are used in a badly neglected condition. Auxiliary steam is used for such purposes as the operation of boiler feed pumps, economiser scraper engines, forced and induced draught fans, steam jets, mechanical stokers, pulverised fuel plant, and the mechanical conveying of coal and ash.

Perhaps the most striking indication of the general lack of appreciation of this important point is the fact that the Electricity Commissioners' annual figures for power station performance in Great Britain merely give the gross thermal efficiency and ignore the question of auxiliary steam and power. It is, of course, preposterous to compare the performance of electricity stations (steam generation and utilisation) as the Electricity Commissioners do, merely on the gross thermal efficiency, when one station may be using, say, 1 per cent. of the steam and another five times as much. For any boiler plant the only efficient method is to arrange that all the steam used for auxiliary purposes shall be supplied by one pipe on which is fitted a steam meter so that a continuous record is given of the total amount.

Most chemical engineers are already well aware of the general principles of pyrometer design and operation, both of the thermo-electric and distance types. A proper equipment of pyrometers is essential to the efficient operation of all but small boiler plants, so as to be able to determine, either in the form of a continuous curve or by means of a control panel with a switch, the temperatures at all the vital portons of the plant, such as the superheated steam, the combustion gases before and after the feed-water economisers and the air heaters, and the feed-water before and after the economisers.

During the past few years also great advances have been made in the general details of scientific instrument design and operation, for boiler plant operation. For example, charts sufficient for six months or even longer can now be used on recording instruments, the various clocks can be wound up automatically by electrical means, and complete central panels are available whereby all the instruments, such as water meters, steam meters, combustion recorders, draught gauges, and pyrometers, are grouped together to facilitate easy reading and recording.

[*Some typical examples of modern boiler house equipment are illustrated in pages* 468-469.]

Underground Oil Depots

Colonel Bristow Suggests a £20,000,000 Scheme

COLONEL W. A. BRISTOW, addressing the Royal United Services Institution on "Oil Supplies in War," on November 13, said that in 1934 we imported 2,752,036,000 gal. of petroleum and its products, an increase of about 311,000,000 gal. over the previous year. The Navy and Air Force were wholly dependent upon oil, the Army very largely. In the event of our being involved in another European war, we should require a great deal of oil. We should certainly need large supplies of petrol for the Air Force, especially as it would probably have to operate each machine for twenty-four hours per day as long as we had machines and relays of pilots to carry on.

Our main supplies of oil were from ten countries, five in the west and five in the east, Dutch Borneo, Iran (Persia), Iraq, Russia, Roumania, and the United States, Mexico, Ecuador, Dutch West Indies, and Peru. Almost half our supplies of crude oil came from Persia and Iraq. The obvious route for oils from Dutch Borneo and Persia in peace time was via the Red Sea and the Suez Canal, but it would be more than difficult to send oil by this route in time of war. In the event of war the fate of the British Empire, so far as her oil supplies wer econcerned, would be in the hands of the United States, Mexico, Venezuela, and the Dutch West Indies.

To overcome the danger of supplies being cut off, Colonel Bristow suggested the provision of large underground storage depôts inland in open country far away from waterways, railways and other possible aerial landmarks. Grass and trees would grow above them in the usual manner, so that the closest inspection from the air would reveal nothing. These underground depôts would be connected with the coast by pipe-line, and it might also be desirable to connect the whole of the system by pipe-line. The scheme might cost as much as £20,000,000, but its existence might conceivably save the country. The capacity of these underground depôts should be large, not less than, say, five million tons. In volume of various oils of different gravities this would be approximately 1,250 million gal., or about five months' supply at last year's rate of importation.

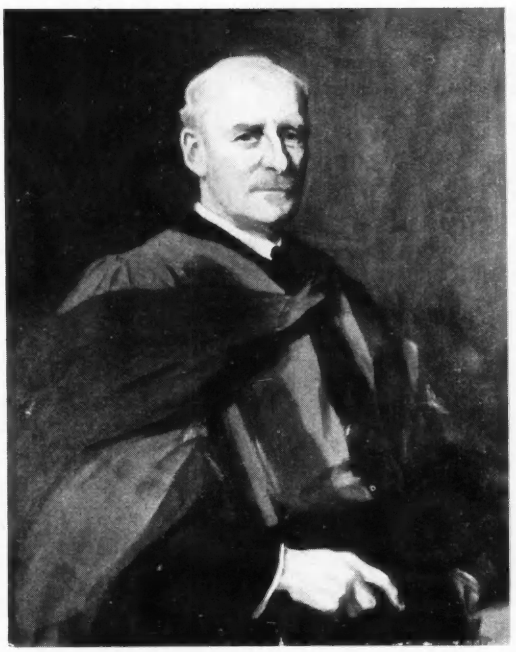
In addition to the establishment of a national storage scheme, it would be of immense advantage if more oil were produced in this country; and quite a considerable amount could be produced from coal. The advantages would be: (1) Less work for the Navy in convoying oil in war; (2) considerable prolongation of the life of our war reserve stocks; (3) complete independence of the Royal Air Force in respect to supplies of motor spirit; (4) more work and increased revenue for the mining industry; and (5) less expenditure on imported oil. In 1928 further supplies of coal oil became available as the result of the starting up of the first Coalite plant, and the output had since been greatly increased as the result of putting the second and third plants into commission. The third plant was operated under licence by the South Metropolitan Gas Co., at Greenwich.

Professor Smithells on the Teaching of Chemistry

The Harrison Memorial Lecture

PROFESSOR ARTHUR SMITHELLS, director of the Salters Institute of Industrial Chemistry, took "The Teaching of Chemistry" as the subject for his Harrison Memorial Lecture to the Pharmaceutical Society on November 12. Unfortunately Professor Smithells was prevented by illness from attending the meeting, and his lecture was therefore read by Mr. E. Saville Peck, president of the Society.

Professor Smithells said in his lecture that for nearly three years during the war he was in close association with Colonel Harrison. No one, he was sure, had contributed more vital service to our army. For the true éloge of Edward Harrison he pointed gratefully to the memorial lectures delivered by Dr. Francis Carr and by the president (Mr. E. Saville Peck). After alluding to his early experiences as an examiner to the Pharmaceutical Society, he said that they left him convinced of the valid claim of pharmacy for university departments of full stature. At the same time, he realised the immense difficulties that lay before the Society in dealing with its educational problems.



Professor Arthur Smithells, F.R.S., Director of the Salters Institute of Industrial Chemistry, Harrison Memorial Lecturer, 1935.

The lecturer proceeded to view the teaching of chemistry in the light of his own experience, beginning with the university professor of chemistry and with those students who came to him, eager, in the ardour of youth, to embrace the study of chemistry for its own sake. The most baffling difficulty lay in dealing with a subject in which the advance had been of almost unparalleled rapidity and, most recently, in changes on the theoretical side which had not only led to the acquisition of tracts of new knowledge, but had affected science at its very base.

The feature that most concerned him was the great burden that university classes now put upon the student, and especially on his memory. Complaints were heard on every side and, in his opinion, relief was urgently called for. The reduction and emendation of the curriculum would, he was sure, result in a gain far exceeding in importance any possible loss in its range.

Passing to the teaching of chemistry, to those whose dominant interest is its application to some particular calling, Professor Smithells referred to students of medicine as an example. He related how, in his own experience, he had been led to place such students in a course apart where he had striven, without any intellectual sacrifice, to invest the teaching throughout with facts and illustrations connected with the medical calling.

He emphasised the importance of the address with which Sir Frederick Hopkins had opened the current session of the Pharmaceutical Society's School. Sir Frederick had challenged the still common dictum that science can only be taught properly when it is taught as pure science, without special reference to its applications, expressing himself convinced by experience that, whilst the creation of a scientific attitude of mind was the first consideration, wise teachers and examiners would find that this most desirable result could be obtained by teaching what is essentially vocational and largely confined to aspects of scientific knowledge which are of permanent and practical value.

Speaking of the teaching of chemistry in schools, Professor Smithells, after making brief reference to its earliest history, passed to the period when, after rapid growth, it had assumed the form in which it was usually found when he became a university teacher; *i.e.*, as a mere small-scale replica in contents and form of the early chemical course of a university. This teaching has led to the revolt, headed by Professor H. E. Armstrong, who, thenceforward to the present day, has stood as the great campaigner against all that had seemed false in chemical education, wherever it has appeared, but, above all, in its earlier stages.

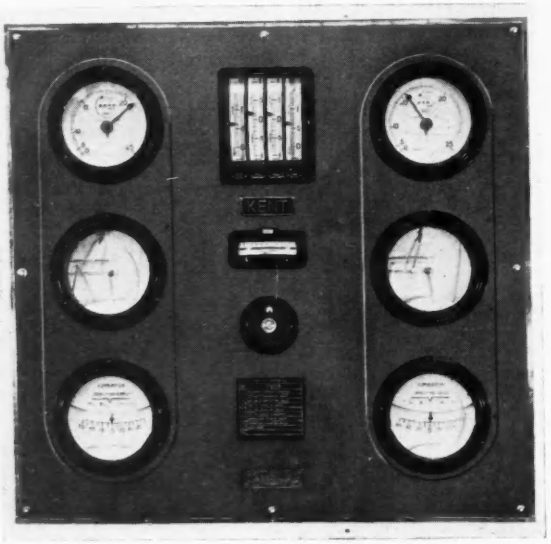
The lecturer discussed the influence exerted inevitably by the university teacher, and considered that it had been far beyond what was warranted. He deplored the crowded state of the curriculum, for which relief had been sought by relegating to the schools so much higher work in science that there was a real danger existing of just that kind of over-balance of one kind of subject, as was the case with classics when science first sought admission to the curriculum.

In conclusion, Professor Smithells alluded to the vast educational structure which had arisen in his lifetime, and the existence of what was now habitually referred to, in terms which must strike a note of alarm into the heart of every true teacher, as the "machinery of education." He did not under-estimate the splendid efforts that were being made, and the enormous difficulties to be overcome. He thought that they had never been so forcibly expressed, nor made so clear, as in the address which had recently been delivered at Norwich by Dr. Pickard-Cambridge, president of the Education Section of the British Association this year. He knew no educational pronouncement of recent times so weighty and so worthy of attention.

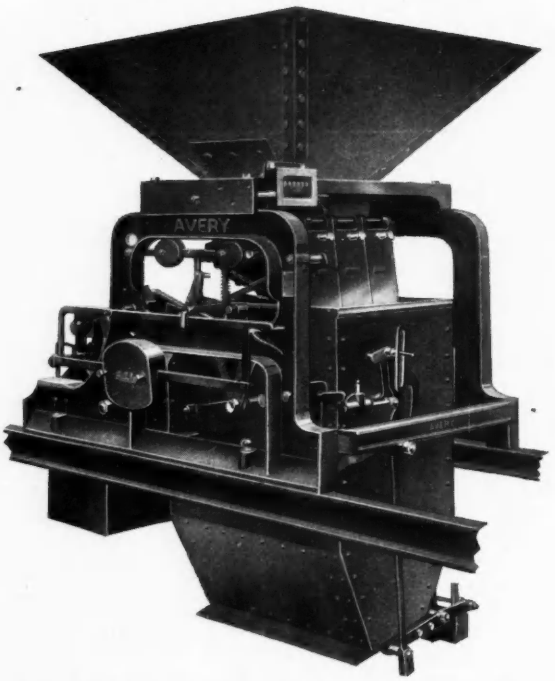
The lecturer expressed the hope and belief that what had been said was in consonance with the mind and spirit of Edward Harrison, a man who, in his range of great virtues, was characterised by an honesty of intellect, a hatred of pretence and pedantry, and an eager enthusiasm for the patient and conscientious pursuit of knowledge for every good purpose of mankind.

PLASTER of paris hardens ordinarily within 30 minutes. This rapid drying is not always desirable and various admixtures have been used in order to lengthen the process of setting. The best results have been obtained from admixture of adhesive substances such as glue or dextrine, but such mixtures occasioned various troubles. A patented German process now produces starch paste in plaster of paris by admixing potato starch and a quantity of caustic soda to the powdered plaster of paris before adding water to it.

Some Modern Boiler House Equipment



A typical Control Instrument Panel for two boilers, including Combustion Efficiency Meters, Draught Gauges and Temperature Indicator (George Kent, Ltd.).

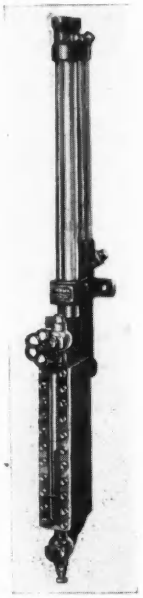


Here is another automatic Boiler Coal Scale designed for weighing coal to mechanical stokers or to pulverisers, feeding furnaces, so that the exact coal consumption of each boiler can be ascertained at any time. By its aid, and with the usual water and electrical energy measurements, a complete station test can be made for every shift (W. & T. Avery, Ltd.).

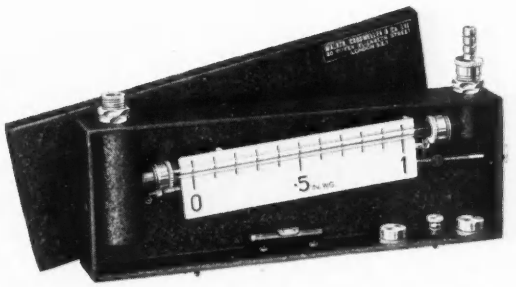
This automatic Coal Weigher, incorporating a special shaker feed gear, marks a great advance in boiler-house weighing, where the coal is liable to be damp or wet; on such coal an ordinary automatic weigher is liable to choke and break the continuity and the accuracy often leaves much to be desired (Richard Simon & Sons, Ltd.).

Multi-point Indicating Pyrometer arranged for use in conjunction with resistance bulbs or thermo-couples for measuring steam, air, gas and water temperatures, the installation covering seven boilers (Foster Instrument Co., Ltd.).

The Kennedy Hot Water Meter for the measurement of feed water is of the positive type; it measures the smallest flows and has an accuracy guaranteed within 1 per cent. of all rates of flow (Glenfield & Kennedy, Ltd.).

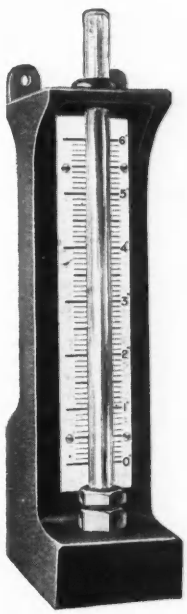


The Igema Distance Water Level Indicator reproduces the boiler water gauge at eye level, indicated by a column of red liquid illuminated from behind (James Gordon & Co., Ltd.)

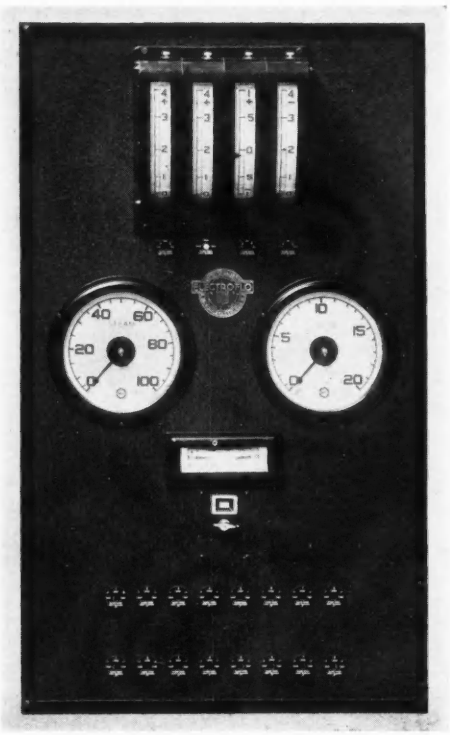


The Arkon Inclined Gauge is a portable gauge which can be arranged with the red oil filling in it. It can be used either for vacuum or pressure, and can be fitted for differential readings (Walker, Crosweller & Co., Ltd.).

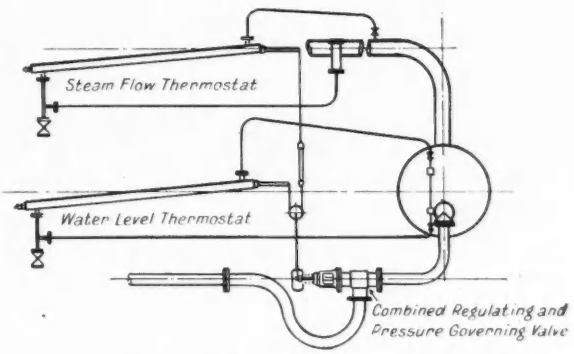
The Mono Combustion Recorder is available in two forms: the "Simplex," recording CO_2 only, and the "Duplex," recording both CO_2 and unburnt combustible gases on one chart (James Gordon & Co., Ltd.)



The Arkon Full-Scale Gauge has a range from 0 to 6 inches W.G. (Walker, Crosweller & Co., Ltd.).



An Industrial Boiler Control Instrument Panel carrying 4-point edgewise type Draught Indicator, electrically-operated Boiler Steam Flow or Load Indicator, electrically-operated CO_2 Indicator, and Multipoint Steam, Feed Water and Flue Gas Temperature Indicator (Electroflo Meters Co., Ltd.).



Diagrammatic arrangement of the Copes Double Control Regulator for controlling the input of feed water in relation to the output of steam (Copes Regulators, Ltd.).

Hydrogen Production by the Badische Process—I

Notes on the Preparation of the Plant Design

In continuation of notes on the Economics of the Synthetic Manufacture of Ammonia, published in "The Chemical Age," October 5 to November 16 inclusive, the present series deal particularly with the design of the plant for the production of hydrogen by the Badische Process.

THE advantage which the so-called Badische process for the production of hydrogen possesses over other methods is due to the fact that not only is the hydrogen produced from the steam used in the catalysis, but also the hydrogen of the water gas is utilised. The steam iron process, on the other hand, employs the water gas only for reduction of the iron oxide. This means that the Badische or water gas catalytic process starts off with an advantage of about 2 to 1 on fuel over other methods.

There are, however, difficulties in connection with the manufacture in subsequent purification of the catalysed water gas. It is with a view to finding out what these really mean in respect of plant, etc., that these notes have been compiled, and also so as to provide a basis for the design when the experimental investigations have been completed.

Water Gas Catalysis

Experimental work has been more particularly applied to the use of the water gas catalysis for the purification of hydrogen from the steam iron process. Experiments with gas containing about four per cent. of CO show that this can be removed by the water gas equilibrium to about one per cent., and that the remaining per cent. of CO can be removed by fractional combustion over the same catalyst with the addition of half a volume of steam and a small quantity of air. If the CO was not previously removed to some extent by the water gas equilibrium, it was not found possible to control the temperature of the fractional combustion sufficiently to prevent the hydrogen from burning. The rising temperature tends to produce conditions favourable to the setting up of the equilibrium and the CO cannot under such circumstances be entirely burnt to carbon dioxide. There was no CO_2 in the original gas, only the hydrogen and CO.

Other experiments were made on gas coming from Lane retorts and the water gas catalysis reduced the percentage of CO from 0.25 to about 0.07, three volumes of steam being present and about 2.5 volumes of CO_2 in the original gas. In all cases it was found that the catalyst produced the amount of CO corresponding closely to the equilibrium figure.

Further experiments carried out on unpurified water gas have shown that the percentage of carbon monoxide can be reduced to between two and three per cent. by the addition of about 2½ to 3 volumes of steam, and, secondly, that about two per cent. of the CO from the resulting gas can be removed by means of fractional combustion over the same catalyst at about 270°. Complete removal of the CO has not, however, been effected.

The catalyst employed in all the above experiments has been the same batch of an iron chromium cerium oxide.

Laboratory Experiments

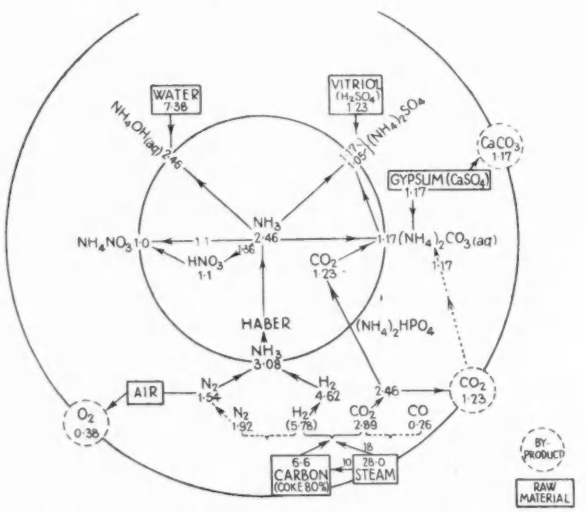
Laboratory experiments have been made on the removal of CO_2 from the catalyst water gas, which will provide the necessary data for designing plant, either for its removal by potassium carbonate or ammonium, etc., but it seems most practicable to use the water washing method under high pressure. The experiments on the removal of CO have been made in various directions in the laboratory. The fractional combustion method above mentioned was first devised by Harger and Terrey, using copper oxide as a catalyst; Rideal and Taylor found that the iron chromium cerium catalyst used for the water gas catalysis was equally effective for the fractional combustion. The removal of CO by caustic soda has been experimented with, by using rapid stirring under high pressure; it is a method which would be likely to prove very troublesome on a large scale, as well as providing an unmarketable quantity of formate of soda.

So far as information goes, the Germans scrub the CO_2 out with water and remove the CO by cuprous ammonium salts under high pressure. The same method has been adopted in America, where it is also proposed to generate the nitrogen for the Haber process, along with the water gas. Here the CO_2 is removed by water scrubbing and the CO by both caustic soda and by copper ammonium carbonate under high pressure. The plant for the high pressure scrubbing appears to be very complicated from the layout received.

A certain amount of experience is available as regards the CO_2 scrubbing from a firm which employs this method of removal of CO_2 from water gas in the production of hydrogen by the Linde liquefaction process.

Sequences of Operations

It is not easy to choose what sequence of manufacture should be followed. There is firstly the question of how the CO is to be removed. Then as to whether the CO_2 is to be removed by high pressure scrubbing or by washing with potash, etc.



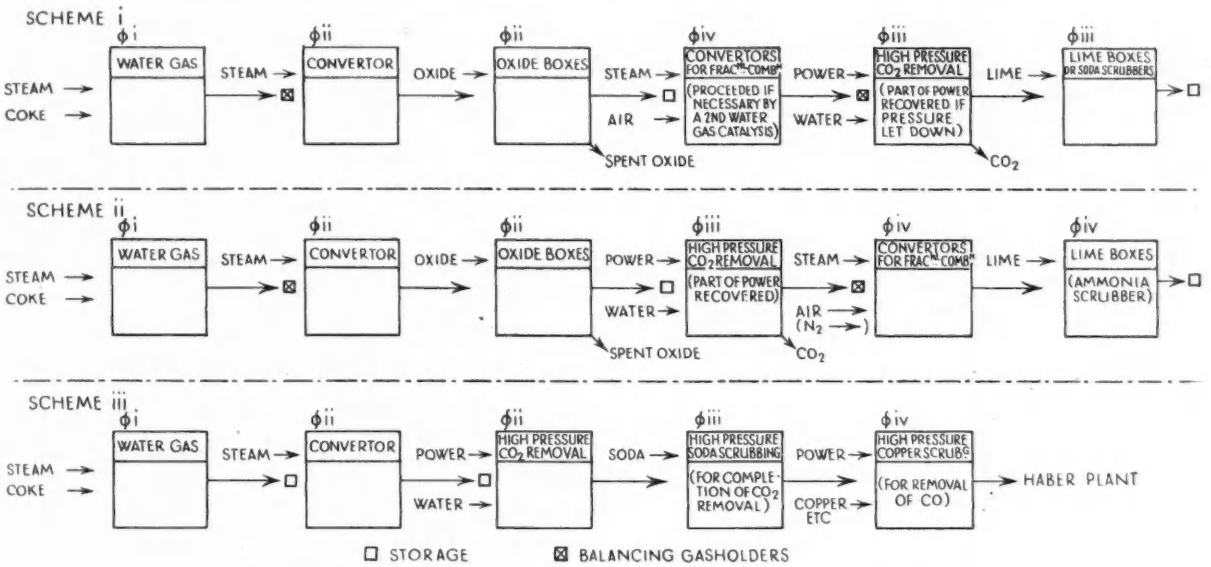
Haber Process and Catalytic Hydrogen. Diagram showing Ammonium Compounds obtained and their molecular proportions at assumed yields.

It is recommended that high pressure water scrubbing should be used for the removal of the CO_2 and that the fractional combustion method should be used for the removal of the CO. Then comes the question as to whether the CO_2 should be removed before the fractional combustion or after. The diagram shows the two sequences which would have to be followed in either case. There is the further question whether nitrogen should be made in the generators along with the water gas. Decision on the above points is difficult without knowing definitely what the ultimate product of the fixation plant is to be.

Assuming the production of 60,000 tons of ammonium nitrate per annum, a scheme has been drawn out which shows the quantities of ammonium sulphate, ammonium carbonate, etc., which can also be produced on the same scale of manufacture (certain assumed yields have been taken). It is clear that the quantity of ammonia produced cannot remove all the CO_2 formed by the catalysis of the water gas in the pro-

duction of the hydrogen. Therefore the removal of the CO_2 by ammonia can at the best only be a half measure and other means would have to be adopted for the removal of the whole.

The following table of quantities has been constructed on the basis of the diagram.



Schemes for Hydrogen Manufacture and Purification by Catalytic Process.

For ammonium nitrate.

60,000 tons ammonium nitrate per annum,
= 89.7 tons ammonia (100 per cent.) per day
= 31,385 tons/annum.
= 92.5 tons nitrogen per day = 2,850,000 cu. ft. per day.
= 19.95 tons hydrogen per day = 8,540,000 cu. ft. per day.

For ammonia liquor.

31,385 tons ammonia per annum = 125,500 tons 25 per cent. liquor.

For ammonium sulphate.

$\frac{(31,385 \times 132)\ 0.95}{34}$ = 115,500 tons ammonium sulphate.
= 330 tons per day.

Requiring $\frac{31,385 \times 98}{34}$ = 90,500 tons sulphuric acid
= 258 tons per day.

or $\frac{(31,585 \times 132)\ 0.855}{34}$ = 104,000 tons ammonium sulphate
= 298 tons per day.

Requiring $\frac{31,385 \times 136}{34}$ = 125,000 tons gypsum (100%)
= 358 tons per day.

Together with $\frac{(31,385 \times 96)\ 0.95}{34}$ = 84,100 tons ammonium [carbonate
= 240 tons per day.

Requiring $\frac{31,385 \times 44}{34}$ = 46,600 tons Co_2
= 116 tons per day
= 2,270,000 cu. ft. per day

CO_2 available from catalysed water gas 5,150,000 cu. ft. CO_2 per day, with 10,300,000 cu. ft. hydrogen per day, making a total of 16,050,000 cu. ft. catalysed water gas per day.

Notes on Design of Hydrogen Plant

The following notes are based on Scheme 2. Water gas is generated and thoroughly scrubbed. It is then passed along with steam through the converters, where the water gas equilibrium takes place, CO_2 and hydrogen being produced from the steam and CO according to the equation :—

$$CO + H_2O = H_2 + CO_2.$$

the hydrogen produced being added to the quantity already present in the water gas. The resulting gas is scrubbed, passed through iron oxide boxes to remove the sulphuretted hydrogen, raised to a high pressure, scrubbed with water to remove the bulk of the CO_2. The pressure is then let down again and the gas is passed through a second set of converters, where the remaining CO is fractionally burnt to carbon dioxide, in the presence of a small excess quantity of air. A certain quantity of nitrogen is produced in this process and it is suggested the remainder of the nitrogen could be added at this stage. The final percentages of CO are then removed by means of lime or first by ammonia and then lime.

Notes on Chart

Theoretically, 1 mol. of carbon gives 2 mols. of hydrogen, but a certain amount of carbon is burnt to supply the heat for the water gas generators. Actually, 214 tons coke (80 per cent.) = 20 tons H_2 (8,560,000 cu. ft.). Therefore, 21.4 × 0.8 = 17.1 tons carbon = 2 tons hydrogen, or 1 mol. hydrogen = 1.425 mols. carbon, *i.e.*, for 4.62 mols. hydrogen = 6.6 mols. carbon, or

$$\frac{2.31 \times 100}{6.6} = 35\%\ \text{yield.}$$

Similarly, 1 mol. steam acts with 1 mol. of carbon in the water gas generator, but actually 36 lb. steam pass into the generators, giving 1,000 cu. ft. water gas,

$$\frac{500 \times 12}{385} = 15.6\ \text{lb. carbon,}$$

or 2 mol. steam act on 1.3 mols. of carbon, or 1.54 mols. steam per mol. of carbon,

$$\frac{1}{1.54} = 65\%\ \textit{yield.}$$

Again, 700 tons steam give 20 tons hydrogen (8,540,000 cu. ft.) Therefore, 1 mol. hydrogen from

$$\frac{70}{18} = 3.89\ \text{mols.}$$

of steam, or for 4.62 mols. H_2 = 18 mols. H_2O, or a yield of

$$\frac{1}{3.89} = 25.7\%\ \textit{yield.}$$

(Steam for fractional combustion is not included, it amounts to 6.0 mols. per 4.62 H_2.)

The catalysed water gas is the mixture shown of H_2, CO_2, CO; a loss of 20 per cent. of hydrogen is allowed for, probably not more than 10 per cent. would be lost. The nitrogen

could be made either along with the water gas or by liquefaction from the air. In the latter case oxygen, or air rich in oxygen, is a by-product. The carbon dioxide could be partly used to neutralise the ammonium carbonate as shown, the remainder would be a by-product or be used for making bicarbonate of ammonia.

The sulphate can either be made by neutralisation with sulphuric acid, or by making the carbonate and treating with gypsum, a yield of 95 per cent. is allowed in the former case and 90 per cent. in the latter case; chalk being a by-product.

The phosphates of ammonia can be produced from ammonia liquor and superphosphates of calcium, but this entails use of sulphuric acid for the production of the latter, and it may be possible to avoid this by working through the carbonate, as with gypsum.

The saving in mols. of *steam* for the catalysed water gas process over the steam iron process is shown as follows:—

For catalysed water gas, 10 for W.G.; 18 for catalysis; and 6 for fractional combustion	= 34
For steam iron, 40 for W.G.; 28 for furnaces	= 68

The saving of carbon is 16.6-6.6 or about 10 mols.

Personal Notes

SIR WILLIAM BRAGG has been elected president of the Royal Society.

MR. H. BOWES, F.I.C., F.C.S., died on November 13 at Heaton Moor.

PROFESSOR JOLIOT and MADAME JOLIOT have been awarded the Nobel Prize for chemistry.

MR. T. W. WORTH has been appointed Bristol representative for the Hubron Rubber Chemicals, Ltd.

MR. S. FRANKENBURG, a director of the Greengate and Irwell Rubber Co., died on November 7 in East Cheshire. He was a J.P. and represented the employers on the committee of the Salford Employment Exchange.

MR. J. MCPHERSON, of Clevedon, Somerset, manager and director of F. F. Fox and Co., Ltd., chemical merchants, who died on July 24, left £2,129, with net personalty £2,089.

PROFESSOR J. CHADWICK, Fellow of Gonville and Caius College, Cambridge, has been awarded the 1935 Nobel Prize for Physics. The award is a recognition of his discovery in 1932 of the existence of the neutron. This marked a new period of brilliant advances in experimental physics, for soon afterwards the new methods of disintegrating atoms and the positive electron were discovered. These achievements have transformed the conceptions of the constitution of atoms and of the material universe.

To commemorate the services of the late SIR JAMES WALKER, who was Professor of Chemistry at the University of Edinburgh from 1908 to 1928, to chemistry in general and to the chemistry department of the University of Edinburgh in particular, it is proposed to establish a fund for a Walker Memorial Lecture to be delivered annually by an eminent chemist invited to Edinburgh by the Edinburgh University Chemical Society for that purpose. Former students of Sir James Walker and any others who may wish to assist in the project are requested to send contributions to Mr. J. E. Rocca, hon. secretary of the Edinburgh University Chemical Society, King's Buildings, West Mains Road, Edinburgh.

THE KING has approved the following awards this year by the president and council of the Royal Society in respect of the two Royal medals:—A Royal medal to PROFESSOR C. G. DARWIN, F.R.S., for his researches in mathematical physics, especially in the quantum mechanics of the electron, and in optics. A Royal medal to DR. A. HARKER, F.R.S., in recognition of his distinguished work and influence as a petrologist. The following awards have also been made by the president and council:—The Copley medal to PROFESSOR C. T. R. WILSON, F.R.S., for his work on the use of clouds in advancing our knowledge of atoms and their properties. The Davy medal to PROFESSOR A. HARDEN, F.R.S., for his distinguished work in biochemistry, and especially for his fundamental discoveries in the chemistry of alcoholic fermentation. The Hughes medal to DR. C. J. DAVISSON for research resulting in the discovery of the physical existence of electron waves through long-continued investigations on the reflection of electrons from the crystal planes of nickel and other metals.

Sir William Alexander re-elected M.P. for Glasgow Central.

BRIGADIER-GENERAL SIR WILLIAM ALEXANDER (Conservative), a director of the Barter Trading Corporation, Ltd., was re-elected for Glasgow Central in the General Election on November 14. Mr. R. Clarry (Conservative), chairman of the British Road Tar Association, retained his seat at Newport, and Mr. Clement Davies (Liberal National), a director of Unilever, Ltd., was returned unopposed for Montgomeryshire. Mr. A. Hayday (Socialist), joint secretary of the National Joint Industrial Council for the Gas Industry, regained his seat at West Nottingham which he lost in 1931. Mr. T. H. Hewlett (Conservative), chairman and managing director of the Anchor Chemical Co., of Clayton, was a new candidate for Clayton, Manchester, but the seat, held by a Conservative since 1931, was won by the Socialist candidate.

MR. J. CLARK, PH.C., of Wood Green, formerly of Burroughs Wellcome and Co., who died on October 4, left estate of the gross value of £2,796, with net personalty £2,731.

MR. H. E. ELLIOTT has been appointed manager of the editorial and advertising department of Newton Chambers and Co., Ltd., manufacturing chemists, Sheffield.

CAPTAIN HENRY G. FORD died last week at St. Austell, at the age of 72. He was connected for many years with the Cornish china clay industry and had a long period of service as captain under the Gover China Clay Co.

Modern Fertilisers and Their Use in Practice

Professor R. G. Baskett Addresses Northern Ireland Chemists

Professor R. G. Baskett, of the Chemical Research Division, Northern Ireland Ministry of Agriculture.

MODERN fertilisers and their use in agriculture formed the subject of a paper which Professor R. G. Baskett read before the Northern Ireland Section of the Institute of Chemistry on November 6.

Approximately 100 years ago, said Professor Baskett, Liebig was asked to see how far chemistry could be utilised in furthering the needs of agriculture and the outcome of this request was the publication, in 1840, of his report on "Chemistry in its application to Agriculture and Physiology." This report was based largely on botanical conclusions and propounded theories of plant nutrition which came as rather a shock to those who had believed that the carbon in plants was derived from humus and dung. Liebig showed convincingly that carbon came from the air and that manures supplied certain inorganic salts which were present in most manures in relatively small amounts. He suggested, therefore, that instead of using vague and indefinite mixtures of manures farmers should apply the essential nutritive elements direct to the soil in the form of salts of potassium, sodium and magnesium and should be guided in their mixtures by the composition of the ash of plants. He prophesied that as good increases in production would be obtained in this way as by the use of organic manures.

About this time, John Bennet Lawes, a Hertfordshire squire, had been making a number of experiments to discover the manurial effects of various substances. Lawes was aware of recent work of chemists who had been studying the composition of bones and who had found that bones were made up chiefly of calcium phosphate. Further work had shown that there was more than one phosphate of calcium and that two were insoluble in water and one was soluble in water.

Experiments with Bones

These facts led him to experiment with the use of bones as fertilisers. Bones had long been known to give good results in some districts but not in all, and it had been found that certain soils in the Rothamsted district did not respond to dressings of ground bones. Lawes, with his knowledge of recent chemistry, hit on the idea of treating bones with acid so as to produce the soluble calcium phosphate in the hope that in the more soluble form the phosphate would be more available to plants. The results were very promising indeed, but would have had little practical value since bones were limited in supply and expensive to buy. However, about this time geologists were discovering huge deposits of mineral phosphates, and Lawes, knowing that they behaved in the same way when treated with acids, used these mineral phosphates to prepare his "dissolved bones" or superphosphate. In 1842 Lawes took out a patent for his process and set up a factory at Deptford.

In addition to using phosphates as a fertiliser, Lawes and his scientific co-worker, Gilbert, had examined the effect of added sulphate of ammonia to the soil. This material was chosen because it was a by-product from the gasworks and there was little demand for it at this time. The response to dressings of sulphate of ammonia was very satisfactory, and Gilbert recognised that it was the nitrogen in the sulphate of ammonia which served as the plant food. The results of these field trials demonstrated very clearly that additions of sulphate of ammonia and superphosphate raised the yield of wheat from 20 bushels per acre to 30 bushels per acre, and, indeed, marked increases in yields were obtained when the fertilisers were used with crops of turnips, barley and grass. This then marked the start of a new era in farming and farmers were not slow to use the new "artificial fertilisers."

Synthetic Nitrogen Compounds

It was in 1898 that Sir William Crookes pointed out that gasworks sulphate of ammonia and the Chile nitrate fields would soon prove inadequate for satisfying the demands of agriculture. He threw out the suggestion that the air offered a ready supply of nitrogen if it could be fixed, and suggested the use of a large electric arc for this purpose. This hint was taken up by chemists in countries where cheap water power was available, and it was not long before the production of nitrate of lime from atmospheric nitrogen had been achieved on a commercial scale. In Germany the Haber process was devised for effecting the combination of nitrogen and hydrogen under moderately high temperature and pressure, and in 1908 the world output of synthetic nitrogen compounds had reached the 1,000 ton level. Since that date the advance has been amazing. In Germany we have the I. G. Farbenindustrie, which produces the largest amount of synthetic nitrogen compounds in the world, and here in England, Imperial Chemical Industries, Ltd., with their huge plant at Billingham, as the second largest producer. Potash fertilisers come from two main sources, the Stassfurt mines and the French deposits in Alsace.

World Consumption of Fertilisers

At the present time the world consumption of fertilisers is of the order of 40 million tons. It is interesting to see the relative proportions of the three main nutrients, namely, P_2O_5, K_2O, and N_2, which are used by the various countries in Europe. These variations are probably not due to the different requirements of the crops in different countries, but to the ease with which the different fertilisers can be purchased and type of agriculture.

The extent to which artificial fertilisers are used by farmers in the British Isles can be judged by the average annual consumption per acre of agricultural land. This works out at a figure of about 2/3 cwt. and provides about 3 lb. N, 7 lb. P_2O_5 and 3 K_2O per acre. Perhaps this figure may seem low, but we must remember that livestock plays a very important part in our agriculture and that large quantities of plant nutrients find their way into the soil *via* the animal, and much of these the nutrients are originally derived from imported feeding stuffs.

In England a process has been recently developed for the

preparation of ammonium phosphates on a large scale. The principle is the treatment of ground rock phosphate with a mixture of sulphate of ammonia, and sulphuric acid and the reaction which takes place is as follows:—

$$Ca_3(PO_4)_2 + (NH_4)_2SO_4 + 2H_2SO_4 = 3CaSO_4 + 2NH_4H_2PO_4$$

mono-ammon.phosphate.

The solution is filtered from the $CaSO_4$ sludge and treated with ammonia to neutralise the free acid present. Iron and aluminium phosphates are filtered off and the filtrate concentrated to crystallise out the mixture of mono-ammonium phosphate and ammonium sulphate The proportion of the two salts may be varied by the quantity of reagents used in treating the original rock. The calcium sulphate sludge is treated with ammonia and carbon dioxide to form $CaCO_3 + (NH_4)_2SO_4$,

$$2NH_3 + H_2CO_3 + CaSO_4 \rightarrow CaCO_3 + (NH_4)_2SO_4,$$

which is reused in the process. The $CaCO_3$ is used in the preparation of nitro-chalk.

The availability of such substances as ammonium phosphate, ammonium nitrate and other salts at a cheap price has led to the production of what is known as concentrated complete manures. These have been put out in the form of small granules which make it possible to sow the manures with drills and ensure a very even distribution. This is an important point, for the even distribution of plant food constituents is essential for best crop yields, and this has been clearly demonstrated in many crop trials. Another point in the favour of this concentrated fertiliser is the lower carriage for the same amount of plant nutrients and also the lower cost of distribution.

Colour Testing and Recording

A Lecture to the Oil and Colour Chemists' Association

THE very nature of colour rendered its testing a very difficult task, said Mr. Norman Bland, B.Sc., A.I.C., in a lecture delivered to the Oil and Colour Chemists' Association at Glasgow, on November 8.

The method of judging a colour in relation to a standard —colour matching—had proved the simplest and most useful method for industrial purposes. A careful outline of the methods employed in the laboratory was given by the lecturer with details as to the precautions necessary to ensure good results. He then spoke of methods of testing the strength of pigments and the various reducing agents employed, and interesting comparisons were made between British and American specifications.

Mr. Bland then spoke of colour recording. Dealing with the Lovibond Tintometer he explained the effect of the various screens. By their use in suitable strengths it is possible to absorb the unwanted rays and only allow those to pass which are necessary to build up the required shade. In using this instrument the substances to be measured and the colour standard are viewed under identical conditions. Originally daylight was recommended, but in the modern form artificial light is used and this greatly increases the usefulness of the apparatus.

Matching Bright Colours

In matching bright and saturated colours, such as the modern pigment dyestuffs, the matching can only be carried out by first dulling down the colour under test by means of neutral glasses. This has the effect of impairing accuracy to some extent.

As an industrial instrument for use in the paint trade, the Lovibond Tintometer has much value, especially where all the testing for any particular branch of work can be carried out by the same individual. When a particular shade of paint is decided upon as a standard, a reading is taken in the tintometer and this gives a permanent record. For most purposes it is sufficient to make a record of the glasses used: this is all the data required for regaining the shade on any future occasion.

The Guild Trichomatic Colorimeter depends on rather a different principle; for here the standard shades are built up by taking the different coloured light rays and superimposing them on a white ground. Three primary colours are used which when combined in equal units give a neutral or white tint. This system can be expressed by an equilateral triangle in which each corner represents an equal amount of the three primaries, red, green and blue. The centre of the triangle represents white, and all shades which can be produced from these primaries are represented by a point on the triangle. The instrument is a device for viewing a small area (less than 0.5 sq. cm.) of the colour under test in juxtaposition with a comparison colour compounded from light which has passed through three primary filters. The mixing of the three primary colours to give the compounded comparison colour is effected by a periscopic prism, collecting light from all three in proportion to the extent of the aperture of each which can be adjusted at will by turning three knobs.

Illumination is carried out by means of a 1,000 watt gas-filled lamp, run at a specified voltage, and a double liquid filter is used to convert this light to some standard of daylight. Any set of primaries could be used, but the red, green and blue were chosen to correspond with the corners of the trichomatic triangle. The light passing through these filters is collected and directed in a single beam; it passes into the telescope and is seen as a patch touching that of the unknown colour and is identical with it in shape and size. When a match has been obtained the scale readings are noted. The majority of colours can be matched in this way, but should the colour be too saturated for a match to be obtained, there is a device by which a small variable amount of any one of the three primaries, or the unaltered white light, may be added to the colour under test and thus it is brought within the range of measurement.

Eliminating the Personal Element

The two instruments described have depended on the human eye. An instrument has been evolved which eliminates the personal element. It depends on the fact that when light falls on certain substances the energy due to the light rays is transformed into another form of energy—known as photo-electricity—and by the use of the photo-electric cell this energy can be measured. The cell consists of a glass bulb containing an inert gas, such as argon, at a low pressure. Its inner surface is coated with a film of alkali metal (lithium, potassium, sodium or caesium) and suspended in the cell is an anode which is in the form of a tungsten ring. The anode is connected to the positive of a battery and the metal lining to the negative pole; a galvanometer is also in the circuit. When a beam of light falls on the cell, the light energy is transformed and the current variation is shown on the galvanometer. This gives an absolute measurement of the light.

In the photo-electric photo-colorimeter the light from a lamp source is collected, passed through coloured filters on to a reflecting surface and thence to the photo-electric cell. The colour is represented graphically by a curve, the abscissæ denoting the hues in wavelength and the ordinates the luminous intensities. This is called the "colour curve." A "matching curve" is made by taking the standard readings as 100 per cent. and the sample readings as percentages of these.

The Future of Natural Resins

Mr. T. Hedley Barry Urges a Greater and More Intelligent Use

Mr. T. Hedley Barry.
(Photo Parker Studios)

ADDRESSING the Manchester Section of the Oil and Colour Chemists Association on November 8, Mr. T. Hedley Barry, F.I.C., emphasised the fact that, quite apart from the immediate question of the position of the natural resins in the paint and varnish industry, the future of natural resins was a subject of immense importance for it was part of the great problem which was realised by thinking men to be of fundamental importance to the welfare of humanity, namely, the maintenance of the correct balance between the products of field, forest and factory.

The British Empire, said Mr. Barry, was the greatest land-owning organisation in the world, and the wise development of the natural vegetable resources and the preservation of the conditions necessary for the maintenance of the supply was of the greatest importance to every one of us. Turning to questions relating to the position of the natural resins in the oil and colour industries, he said he proposed to make a survey of the principal resin-producing areas and discuss briefly the problems presented by each and the steps being taken to improve the product in quality and consistency.

Copals from Belgian Congo

The areas of the greatest interest were the Belgian Congo which supplied nearly 40 per cent. of the copals being used at the present time, and the Dutch East Indies and Malaya which supplied almost an equal proportion of copals and practically all the damar. Of the other regions New Zealand, where efforts were being made to utilise the residues of Kauri left in the ground, was of interest. As to colophony and shellac, which were of such great importance, he proposed to confine himself to some comments on the more recent work in the United States, as illustrating the importance and value of research in the development and preservation of forests and at the same time indicating the methods to be adopted in solving some of the problems referred to in connection with the other resins. This did not permit of detailed reference to the work of the Indian Forestry Office in the successful development of a flourishing naval stores industry, but he could not deny himself the privilege of referring to it and also to the equally brilliant work of the Lac Research Institute, which was actively pursuing research into the production and utilisation of lac.

Turning to the natural resins, Mr. Barry described the development of the resin industry in the Belgian Congo. On the technical side he referred to the modern methods of cleaning and grading the copals in Belgium and said that the introduction of these methods had reacted favourably upon the use of the resin in industry, for they gave the chemist confidence in the raw material. Of these technical developments the introduction of esterified copals and of "run congo" were of great and far-reaching importance; the concentration of the "gum running" process in large units opened up many possibilities in the more economical use of the resin, and a solution of the problem of utilising the volatile decomposition products which accounted for about 20 per cent. of the resin was evidently one which claimed attention.

It was possible that means might be found to render the resin oil-soluble without losing these "fumes" at all, but so far all attempts had failed. The utilisation of the "fumes" was the most promising line of work. In the United States the high boiling point fractions obtained in the treatment of pine stumps for resin and turpentine were being used as raw material for the manufacture of a series of terpene derivatives. Possibly some such development might take place with "gum running fumes," which consisted largely of higher terpenes. It was clear in any case that here, in the Belgian Congo, was an abundant raw material of proved value in its present form and capable of modification to forms useful in other connections.

As to the Dutch East Indies, both the copals and damars had been the subject of much research. The former were found mainly in the more western portions of the area and the headquarters of the research work was Malili, in Celebes. Here, under the able guidance of C. van de Koppel, the tapping of the copal trees had been standardised, having due regard to the health and preservation of the tree. How important that was, was shown by lantern slides which illustrated the results of wasteful native methods and the standard methods introduced as a result of van de Koppel's researches. It was of interest to note that the *Agathis alba*, which produced the resin, was a close relative of the tree producing kauri in New Zealand, and a more distant relative of the pine trees producing colophony. This relation was also reflected in the chemical composition of the resin. The acid "agathic acid" occurred in New Zealand kauri and possessed structural relations with abietic and pimaric acid of the pine tree resins.

Research in British Malaya

The damars had been the subject of much research in British Malaya and, as in Celebes, the importance of correct methods of tapping were proved. Mr. Barry drew special attention to the investigations on the properties of the "wax" which was removed from damar before it was used in the manufacture of cellulose lacquers. It appeared that the value of this was becoming more appreciated, particularly in Germany, where many interesting patents were taken out. Turning to New Zealand, the problem of extracting the kauri still remaining in the soil in pieces too small for individual collection was now being vigorously attacked, and with the development of chemical industry in Australasia and consequent improvement of solvents and chemical plant it was probable that in spite of the unhappy fate of many past attempts success might be obtained. The work of Dr. J. Hosking, both in this connection and in the scientific study of kauri, was deserving of much wider recognition than it had received so far.

Mr. Barry said he deprecated any violent prejudice on the part of the chemist in regard to the relative merits of natural and synthetic resins. Ultimately the function of the oil and

colour chemist was to make better paint and varnish, and, whilst the chemist must do his utmost to further the interests of the manufacturer who employs him, he should maintain an even balance and not let himself be led astray by the arts of the advertiser. Until recently, the natural resins had suffered from the lack of published scientific data concerning their properties and the best method of using them. The recent publication of the researches carried out under the auspices of the American Gum Importers' Association had shown that by the use of china wood oil on the lavish scale demanded by the makers of synthetic resins, varnishes made from the natural resins were even more desirable than the corresponding synthetic resin varnish. Moreover, the natural resins were very much cheaper grade for grade. It appeared, therefore, that the secret of durability and quick drying resided not in the synthetic resin but in the oil and the heat treatment thereof. Unless the economic situation with regard to china wood oil underwent a sudden and dramatic improvement of a permanent character, the chief problem confronting the seekers after quick drying and durability would be in connection with modification and treatment of the oil rather than the resin.

It was significant that with the revival of industry the use of natural resins had increased. The statistics of the past ten years showed that during the past year the natural resin output increased almost to the figures of ten years ago, and it was significant as regards imports that Germany, which more than any other country had developed synthetic processes and practised self-sufficiency, was taking a proportionally increased amount of damar and copal.

A Method for the Determination of Benzene

Investigations by the United States Bureau of Mines

A REPORT on a microcolorimetric method for the determination of benzene has been prepared by the staff of the gas section at the Pittsburg Experimental Station of the United States Bureau of Mines ("U.S. Bureau of Mines Report of Investigations, 3287"). According to the report, the most widely used method in the United States for determining benzene vapour in air is the Smyth modification of the Elliott and Dalton procedure. This depends on the nitration of the benzene to *m*-dinitrobenzene, reduction to phenylenediamine with an excess of standard titanous chloride solution, and back titration with a standard ferric ammonium sulphate solution. This method has the disadvantages of being somewhat time-consuming and cumbersome; it requires considerable apparatus, and a special modification is necessary in the presence of toluene.

The method recently developed and employed by the United States Bureau of Mines at its Pittsburg Experimental Station is as follows. The benzene, in liquid or vapour phase, is nitrated to *m*-dinitrobenzene with a mixture of fuming nitric and sulphuric acids. The acid mixture is neutralised, extracted with one 10-cm³ portion of butanone and 1.5 cm³ of 40 per cent. sodium hydroxide solution added to the butanone extract. A colour develops, the intensity of which is proportional to the amount of *m*-dinitrobenzene present. A series of standards containing known amounts of *m*-dinitrobenzene are prepared simultaneously for comparison

Details of the Apparatus

The benzene-air samples are taken either directly from the atmosphere through 2 cm³ of nitrating mixture in a bubbler, or first collected in a vacuum bottle and then forced through the bubbler by displacement with mercury. If mercury is not available it can be swept through the bubbler with benzene vapour-free air. The rate of bubbling is 20 to 30 cm³ per minute. Results show that with concentrations of benzene as low as 25 p.p.m. by volume a 250 cm³ volume of the vapour-air mixture is ample for determination. This makes it possible not only to collect vacuum-tube samples but also to aspirate a sufficient sample through the nitrating mixture with several squeezes of a calibrated aspirating bulb, aspirating bottle, or burette. The vacuum tube should contain a small amount of mercury so that after collecting the sample and closing the opening with rubber tubing and a piece of glass rod the vacuum tube can be inverted and a mercury seal formed to prevent contact of the benzene vapour with the rubber. The vacuum tubes have the advantage that a large number of samples can be taken in the field and shipped to the laboratory for nitration and analysis, thereby decreasing the time necessary to be spent in the field.

The dinitrobenzene formed is determined by transferring the nitrating mixture and beads to a 100 cm³ glass-stoppered flask, and the bubbler washed with five 1-cm³ portions of distilled water which are also added to the flask. The acid solution is neutralised in a cold-water bath by titrating slowly with 40 per cent, sodium hydroxide, using litmus paper as an indicator, one to two drops being added in excess. Ten cm³ of butanone are added to the neutralised solution and shaken occasionally over a period of 10 minutes. It is important at this stage that the flask and contents be kept warm—about 25° to 30° C.—to prevent salts from crystallising, thus interfering with quantitative separation of the butanone layer. The separation is effected with a small pear-shaped separatory funnel and the butanone transferred to one of a series of comparator tubes of equal diameter.

Preparing the Standard Solution

One and a half cm³ of a 40 per cent. aqueous sodium hydroxide solution is then added to the butanone. The tube is shaken vigorously for several minutes and occasionally during 1 hour to 1½ hours allowed for the colour to develop. A standard stock solution of 33.8 mg of *m*-dinitrobenzene in 50 cm³ of nitrating acid is prepared. One cm³ of this solution is equivalent to 0.50 mg of benzene. A portion of the stock solution is diluted with nitrating acid so that 1 cm³ of the dilute solution is equivalent to 0.05 mg. of benzene. This dilute solution is used as the standard. It has been found to remain unchanged for at least five months. If the colour developed by treatment of the nitrating acid through which the sample of air to be examined was taken is too intense for comparison with the standards the coloured butanone layer is separated from the sodium hydroxide layer in a burette calibrated to the tip to measure accurately the amount of butanone. An aliquot portion of the butanone is then diluted with butanone to the previous measured volume. If the aliquot is 1 cm³ or less, 0.7 cm³ of the sodium nitrate-sodium sulphate solution is added to the butanone and shaken. As the volume of the aliquot is increased the volume of the sodium nitrate-sodium sulphate solution is proportionately decreased.

If the amount of benzene nitrated can be estimated roughly from the odour or general knowledge of the prevailing conditions another procedure may be followed. The nitrating acid may be diluted with nitrating acid to a definite volume, so that an aliquot of 2 cm³ or less will bring the amount of benzene within the 0.01- to 0.06-mg. range. The neutralised solution also may be diluted with water and an aliquot taken. This latter method is limited by the insolubility of *m*-dinitrobenzene, for if as much as 3 mg. of benzene is present a precipitate of *m*-dinitrobenzene is produced on neutralisation of the nitrating mixture, making it difficult to obtain a representative aliquot.

Notes and Reports from the Societies

Society of Dyers and Colourists

Staybrite Steel in the Dyeing Industry

STAYBRITE steel as applied to the dyeing industry was the subject of a paper which Mr. F. Godber read at a meeting of the Manchester Section of the Society of Dyers and Colourists on November 15, Mr. L. G. Lawrie, A.I.C., presiding. The lecturer stated that the advantages resulting from the use of Staybrite steel were (1) the elimination of damage of fabrics caused by rust and metal staining; (2) the lengthening of the life of the plant and reduction in the loss of time due to frequent attention; (3) the steel had a combination of toughness and tensile strength which made it valuable in thin and light combinations, and its mechanical properties were superior to many other substances now used in difficult circumstances; (4) it was easily cleaned and changes of colour could follow in the same vats in rapid sequence; (5) no boiling out was necessary, there was a saving of time and steam, and the plant was quickly available again; (6) there was no absorption of dyestuffs in the Staybrite vat, resulting in a better return from the liquor; and (7) the resistance which Staybrite steel offered to the attack of many chemicals did not depend on any surface treatment, or superficial plating.

In the textile industry the problem of corrosion had always been acute. At first the chief aspect was an economic one. Depreciation of plant due to the corrosive action of strong acids and alkalies had to be kept within bounds. Latterly, however, a secondary but no less important aspect had demanded attention. Owing to the increasing complexity of its products it was found necessary to guard against corrosion to avoid contaminations, for a complex reaction could often be rendered uncontrollable owing to the presence of some reactive body in one of the reagents.

A Review of Available Materials

A brief review of the principal materials which were to a greater or lesser degree non-corrosive, or which were durable and at the same time did not abstract any component from the process liquors nor release any components themselves, showed that complete fulfilment of every condition was exceedingly difficult of attainment. Leaving out of consideration the oldest material of plant construction, *i.e.*, wood, there were available cement, rubber, synthetic resins, metals, and alloys, and there were limits to the use of each. Cement, in none of its commercial forms, was acid resisting; rubber was attacked by acetic acid, and did not completely resist caustic solutions. Synthetic resins and the protective surfaces made from them, in the laminated form or otherwise, were corroded by lactic acid and acetic acid. Copper and iron were not resistant and were very active catalytically; peroxides and hypochlorites, especially hydrogen peroxide, were dissociated by the catalytic action.

There were, however, certain difficulties associated with the use of Staybrite steel, for it was costly and difficult to work; and, owing to its high coefficient of expansion, folded joints were unsuitable. Welded joints were necessary and expert workmanship must be employed. Mr. Godber said he was frequently asked if stainless steel and Staybrite steel were one and the same thing. Stainless steel was produced by the addition of about 13 per cent. chromium to the steel, and in standard material the carbon content was in the vicinity of 0.3 per cent. Stainless iron was really a low carbon stainless steel, namely, about 13 per cent. chromium and about 0.1 per cent. carbon. Staybrite steel, however, represented a group of special steels containing a high percentage of chromium, and also a high percentage of nickel, together with a small percentage of other special alloying elements. It was dissimilar from stainless steel owing to the fact that the addition of nickel along with the chromium produced a type of steel which did not harden when quenched from a high temperature.

Oil and Colour Chemists

Manchester Section : Annual Dinner

THE eleventh annual dinner of the Manchester Section of the Oil and Colour Chemists' Association was held at "The Manchester" Limited Restaurant, on November 8, when the efforts of the committee and hon. secretary, Mr. H. Gosling, were well rewarded in the record attendance of 232 members, friends and guests, who upheld the traditions of the section throughout the evening. The chairman, Dr. V. G. Jolly, Ph.D., F.I.C., presided.

The toast of "The Manchester Section of the Oil and Colour Chemists' Association" was proposed by Mr. A. P. BEVAN, president of the National Federation of Associated Paint, Colour and Varnish Manufacturers, the chairman responding.

Mr. G. A CAMPBELL, M.Sc., president of the Association, proposed "Our Guests" in his usual humorous vein, and mentioned the names of Mr. A. P. Bevan (president of the National Federation of Paint, Colour and Varnish Manufacturers), Dr. E. C. Pickering, Ph.D., F.I.C. (head of Department of Chemistry, Borough Polytechnic, London), Mr. J. S. Wilson (Scottish chairman), Mr. A. J. Gibson (honorary secretary of the Association), Mr. F. B. Osborne (president of the Incorporated Institute of British Decorators), and Mr. G. Copping. Dr. E. C. PICKERING, PH.D., F.I.C. (head of Department of Chemistry, Borough Polytechnic, London) responded to this toast.

Institute of Metals

Swansea Section : Chairman's Address

IN his chairman's address to the Swansea Section of the Institute of Metals, on November 12, Mr. Roosevelt Griffiths emphasised the fact that our progress in metallurgical knowledge had not been sufficiently organised and balanced. Fundamental phenomena in the science and practice of metallurgy were still unexplained, and little concerted effort had been made to solve them. Whilst in some directions very advanced progress had been made in research, yet vital problems had received scant attention. A periodical stock-taking of our knowledge in various branches would do much to draw attention to those problems which need further investigation. This was a sphere where the scientific institutes, and particularly the Institute of Metals, could perform a useful and national service. Whilst a few specialised committees were already in existence, much further effort was required to tackle various other branches of metallurgy by means of committees working under the direction of a central body.

Cold Glazes with a Cement Basis

ACCORDING to the Report of the Building Research Board for 1934 (H.M. Stationery Office, 3s. 6d. net) considerable interest has been displayed by the industry in cold glazes having a cement basis. The report refers to two types, the first produced by casting a mixture of cement and other material on glazed or burnished metal, while the second type is produced by spraying with a suitable backing, such as asbestos cement sheeting, a suspension consisting of neat cement and water, to which metallic soaps or other substances are frequently added. Some forms of this process aim at the production of a glaze in the cement coat itself, others produce the glaze by the application of a film of cellulose or synthetic resin. Products of this kind, the report states, have a limited but definite field of application, but it appears that much harm is done by such exaggerated claims as that they are equivalent to ceramic glazes in durability and cleanliness, resistance to staining and to the weather.

British Overseas Chemical Trade in October

Large Increase in Exports

ACCORDING to the Board of Trade returns for the month ended October 31, exports of chemicals, drugs, dyes and colours were valued at £1,997,140 as compared with £1,798,007 for October 1934, an increase of £199,133. Imports were valued at £1,366,616, as compared with £1,056,309. Re-exports were valued at £45,676.

Imports

	Quantities. October, 1934.	Quantities. October, 1935.	Value. October, 1934. £	Value. October, 1935. £
Acids—				
Acetic .. .. cwt.	19,990	20,272	31,964	29,110
Boric (boracic) .. ,,	2,516	3,900	2,539	3,669
Citric .. .. ,,	550	1,059	1,557	4,091
Tartaric .. ,,	976	1,990	4,214	8,378
All other sorts .. value	—	—	10,326	12,081
Borax .. .. cwt.	11,040	9,000	5,528	5,045
Calcium carbide .. ,,	131,279	97,304	72,064	54,735
Phosphorus .. ,,	1,805	2,361	5,867	7,770
Potassium compounds—				
Caustic and lyes cwt.	12,484	12,888	15,104	13,700
Chloride (muriate) ,,	215,302	298,770	61,256	89,417
Kainite and other mineral potassium fertiliser salts .. cwt.	292,433	459,893	49,345	80,544
Nitrate (saltpetre) ,,	1,629	9,653	1,753	7,951
Sulphate .. ,,	126,942	228,114	44,224	94,194
All other compounds ,,	10,279	14,125	18,184	22,753
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	162	182	121	145
Chromate and bichromate .. .. cwt.	2,511	6,198	3,696	7,816
Cyanide .. .. ,,	805	7,340	1,918	17,434
Nitrate .. .. ,,	80,198	30,910	15,636	6,114
All other compounds ,,	19,836	22,431	12,424	14,554
Other chemical manufactures .. .. value	—	—	222,786	324,781
Drugs, medicines, etc.—				
Quinine & quinine salts oz.	82,761	105,963	6,983	8,909
Medicinal oils .. cwt.	3,695	2,788	10,716	14,483
Ointments and liniments cwt.	8	106	220	1,304
Proprietary medicines value	—	—	43,991	42,540
All other sorts, manufactured or prepared value	—	—	25,741	39,193
Bark Cinchona (bark Peruvian, etc.) cwt.	654	559	2,423	2,454
All other sorts, raw or simply prepared value	—	—	41,316	53,676
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs (coal tar) .. .. cwt.	5,303	4,638	131,474	131,568
Extracts for dyeing ,,	4,935	3,946	13,420	10,345
Chestnut extract .. ,,	31,675	25,518	21,516	17,030
Quebracho extract ,,	33,508	13,131	18,747	10,711
All other extracts for tanning .. .. cwt.	51,886	99,744	34,672	68,831
All other dyes and dyestuffs .. .. cwt.	523	803	10,457	14,344
Painters' colours and materials—				
White lead (basic carbonate) .. cwt.	7,932	8,908	9,252	11,305
Lithopone .. ,,	16,482	21,258	10,433	13,175
Ochres and earth colours cwt.	35,258	35,193	11,385	11,572
Bronze powders ,,	1,487	2,301	10,253	15,116
Carbon blacks .. ,,	19,094	30,193	30,743	55,440
Other pigments and extenders .. cwt.	30,528	31,491	9,160	8,805
All other descriptions ,,	17,890	13,335	32,901	31,533
Total .. .. value	—	—	1,056,309	1,366,616

Exports

	Quantities. October, 1934.	Quantities. October, 1935.	Value. October, 1934. £	Value. October, 1935. £
Acids—				
Citric .. .. cwt.	2,856	3,287	10,242	14,746
All other sorts .. value	—	—	19,618	22,932
Aluminium compounds tons	6,151	7,896	62,990	73,701
Ammonium compounds—				
Sulphate .. tons	32,917	19,519	195,063	117,256
All other sorts .. ,,	2,019	4,159	25,904	44,398
Bleaching powder (chloride of lime) .. cwt.	66,162	79,402	16,758	19,813
Coal tar products—				
Cresylic acid .. gal.	126,155	152,280	11,859	15,371
Tar oil, creosote oil, anthracene oil .. gal.	1,341,830	1,093,617	27,188	33,529
All other sorts .. value	—	—	11,129	17,874
Copper, sulphate of tons	1,843	1,532	25,337	21,409
Disinfectants, insecticides, etc. .. .. cwt.	39,108	37,104	84,143	80,442
Glycerine .. .. ,,	19,326	11,320	40,007	27,018
Lead compounds .. ,,	14,130	17,882	16,873	21,149
Magnesium compounds tons	505	492	11,765	11,757
Potassium compounds cwt.	6,610	10,716	14,844	17,587
Salt (sodium chloride) tons	35,722	28,175	95,477	70,238
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	255,436	312,752	71,118	78,264
Caustic .. .. ,,	155,501	217,510	91,318	109,590
Nitrate .. .. ,,	11,670	33,673	4,341	11,296
Sulphate, including salt-cake .. .. cwt.	87,196	120,939	10,442	9,792
All other sorts .. ,,	66,669	82,712	70,485	88,961
Zinc oxide .. .. tons	940	1,191	17,855	22,597
All other descriptions value	—	—	224,635	261,343
Drugs, medicines, etc.—				
Quinine and quinine salts .. .. oz.	105,122	161,103	13,074	16,901
Proprietary medicines value	—	—	101,573	127,759
All other descriptions ,,	—	—	145,895	172,615
Dyes and dyestuffs and extracts for dyeing—				
Alizarine, alizarine red and indigo (synthetic) cwt.	978	2,544	7,016	17,371
Other finished dyestuffs (coal tar) .. cwt.	7,092	7,955	86,638	115,835
All other descriptions ,,	17,336	29,124	23,680	36,563
Painters' colours and materials—				
Ochres and earth colours cwt.	17,184	17,824	15,752	18,137
Other pigments and extenders, dry .. cwt.	18,655	29,465	26,126	42,109
White lead .. ,,	6,051	7,281	11,292	14,262
Paints and painters' enamels, prepared cwt.	39,952	44,906	104,523	121,212
Varnish and lacquer gal.	64,128	103,027	26,490	40,024
All other descriptions cwt.	34,735	43,524	70,557	83,061
Total .. .. value	—	—	1,798,007	1,997,140

Re-Exports

	Quantities. October, 1934.	Quantities. October, 1935.	Value. October, 1934. £	Value. October, 1935. £
Chemical manufactures and products .. value	—	—	18,087	17,247
Drugs, medicines, etc.—				
Manufactured or prepared .. .. value	—	—	10,600	12,532
Raw or simply prepared value	—	—	21,340	13,805
Dyes and dyestuffs and extracts for tanning cwt.	496	526	809	1,403
Painters' colours and materials .. .. cwt.	626	286	1,076	629
Total .. .. value	—	—	51,912	45,676

Continental Chemical Notes

Manchuria

THE GRANT OF A CONCESSION to the Imperial Oxygen Co. (a subsidiary of the Air Liquide), for erection of a liquid oxygen works at Mukden, is reported.

Norway

THE CONSTRUCTION OF A NEW FACTORY is announced for the refinement and hardening of vegetable and animal oils by a new concern, Sandar Fabrikker A.S., at Sandefjord. The commencing daily output is given as 60 tons.

Finland

MANUFACTURE OF LIQUID SULPHUR DIOXIDE from the waste gases of the Imatra copper works (now approaching completion) will be undertaken by the Outokumpu O.Y. The greater part of the anticipated output has already been sold to the sulphite cellulose factories in the country.

Russia

A PROCESS FOR EXTRACTING ZIRCONIUM AND HAFNIUM SALTS from Ural ores has been developed at the Ukranian Chemical Institute in Odessa and is to be tried out on the manufacturing scale.

THE PRINCIPAL ESSENTIAL OILS now being cultivated in Russia are rose (249 hectares under cultivation in the Crimea and the Black Sea district of Asow), peppermint, anise and coriander (100,000 hectares under cultivation to be increased next year by 15,000 hectares). The essential oil content of the coriander is understood to range from 0.8 to 1 per cent.

Sweden

A RAYON FACTORY IS NOW BEING BUILT at Norrköping by the Kooperative Forbundet, who will also manufacture there a new thermal insulating material under the brand name of Celloflex. According to a report in "Chemische Industrie" (November 16), this material is 16 times lighter than cork and possesses at least the same insulating value. It is understood that the new product is composed of cellulose and aluminium and it is claimed to be exceptionally suitable for railway and shipping transport since the freight capacity of a railway waggon insulated with Celloflex will be increased by 1 ton and that of a large ship by about 150 tons.

Jugoslavia

EXTENSIVE BAUXITE DEPOSITS are reported to have been located in the district of Gornia Blatnitza in Herzgovina.

Holland

ALKALI PERBORATES are now being made in Holland by the N. V. Industrieele Mj, of Deventer, by a patented process based upon reaction between hydrogen peroxide and boric acid or borates in aqueous solution in presence of traces of soluble salts of magnesium, zinc or the alkaline earth metals. The product obtained is claimed to be of low density and particularly suitable for the manufacture of soap powder, being very stable in aqueous solution even at high temperatures.

Italy

AN EXAMINATION OF THE SO-CALLED CASEIN RAYON now being produced in Italy by the Snia Viscosa has been made by the German State Institute for Applied Botany, reports the "Chemische Industrie." The material is pale cream in colour and composed of fibres ranging in length from 3 to 5 cm. and in width from 0.030 to 0.035 mm. The gases evolved on burning possess a strongly alkaline reaction. No appreciable swelling occurs on immersion in water, but the fibres swell to the extent of about 25 per cent. and become brittle on immersion in about 10 per cent. caustic soda.

France

THE COMPAGNIE DES MINES DE BETHUNE, in its report for the year ending June 30 last, announces the approaching completion of the coal liquefaction plant, work on which was commenced at the beginning of this year by its sister concern, the Carburants Synthétiques des Mines de Béthune. The net profit is maintained at the previous year's level of 17,000,000 francs.

THE BOZEL MALETRA CONCERN reports improved trading conditions in 1934, a dividend of 5 per cent. now being distributed for the first time since 1931. The improved results are due in the main to increased sales of magnesium, the manufacture of which has been carried on by the company since 1932 in association with the Soc. de Produits Chimiques de Terres Rares.

Indian Chemical Notes

Increased Glycerine Prices

PRICES of glycerine in India have risen by 300 per cent., creating a stir among chemists, and attempts to corner supplies are being made. A leading firm of importers has been rationing the supplies after due investigation of the needs of the purchaser. Glycerine being an important ingredient of most medicines, the druggists' trade will be affected if it is not available, but as it is also a necessary ingredient in the production of nitro-glycerine and the manufacture of explosives, the Italo-Abyssinian war has been the main cause of its high price. For many months past the price of glycerine has risen slowly and the prices of drugs and medicines have increased accordingly.

Industrial Research

The latest report of the Harcourt Butler Technological Institute, Cawnpore, shows that during the past year special attention was paid to problems connected with the sugar industry, of which the most important was the utilisation of the factory molasses. The Department sent Dr. N. G. Chatterji, assistant research chemist, to study this question in Europe, and he has now submitted a workable scheme for producing power alcohol from molasses. Experiments are also in progress for utilising molasses for road surfaces and another experiment is being made to make alcohol for mixing with low-grade kerosene oil. Research work is also being done on deodorisation of sugar factory effluents which are a source of great nuisance to the neighbourhood of the factories. In the oil section, successful experiments have been made on bleaching mahua and castor oils and for the preparation of high colour ester gums from rosin. The former is likely to give a stimulus to the production of castor oils and the latter to the paint and varnish trade of the province. It is proposed to start a glass section of the Institute.

Bombay's Trade

According to the review of seaborne trade of Bombay for 1934-35, the imports of chemicals increased from £102,000 in value in the previous year to £121,500, while imports of drugs and medicines stood practically stationary at £114,000. Imports of artificial silk rose from £291,000 in value to £388,500. The imports of dyes rose from £246,000 in value to £318,000. Alizarine dyes increased from 1,500,000 lb. to 2,240,000 lb., arrivals from Germany and the United Kingdom having increased. Aniline dyes increased from 7,800,000 lb. to 10,800,000 lb. Imports from Germany further rose from 4,300,000 lb. to 7,000,000 lb. Arrivals from the United Kingdom rose from 877,000 lb. to 1,006,000 lb. and imports from Japan also rose from 900,000 lb. to 1,021,000 lb. Imports from the United States showed a decrease.

Chemical and Allied Stocks and Shares

Buoyant Market Conditions

At the beginning of the week very buoyant conditions were in evidence in the stock and share markets. This was a reflection of satisfaction in the City with the result of the General Election and of renewed confidence that recovery in internal trade conditions will be continued and possibly accelerated during 1936, granted favourable developments in the international political situation. Imperial Chemical ordinary and deferred have both moved in favour of holders on balance for the week, largely as a result of the conclusion of the litigation over the share conversion scheme. It is realised in the market that, bearing in mind the statements at the last annual meeting, it would be prudent not to look for any marked advance in profits until the conditions of world trade are less difficult, but, on the other hand, the ordinary shares still give a rather larger yield than many other leading industrial shares, and some market men are anticipating a moderately larger dividend for the year. B. Laporte were more active on the possibility of an increase in the interim dividend. Last year nearly 40 per cent. was earned on the shares and the dividend was limited to 20 per cent. Fison, Packard and Prentice have held the recent good rise following the statements at the annual meeting, which created the impression that the business has considerable further scope for expansion, and that despite the larger capital that will rank for dividend, there seem good prospects of the larger rate of dividend being at least maintained for the current year, particularly as much fuller benefits may be reflected from the important extensions of the company's operations and interests effected during the past financial year. The upward movement in Lever Brothers preference units has been continued as a result of the apparently favourable yields offered and the good cover for dividend requirements on the basis of last year's profits. United Premier Oil and Cake were firm. It may be recalled that the custom of paying an interim dividend has been resumed with a payment of 4 per cent., and that this has been taken by the market to indicate that profits are continuing to run at a higher level. According to current market views it is quite possible, granted the continuance of existing conditions, that the total for the year may be raised from 7½ per cent. to 10 per cent. Burt, Boulton and Haywood manufactured their improved tendency, awaiting news of the outcome of negotiations for the sale of some of the company's assets outside its main business. William Blythe remained steady at the higher price made recently, and Salt Union were firm. The latter are held steadily and buyers are in evidence on any reaction. Imperial Smelting have been rather dull on the past year's results, but were better later on a more general recognition that profits in the current year may benefit considerably from the higher price of zinc and the other metals in which the Corporation and its associated undertakings are interested. United Molasses were more active at higher prices, awaiting the impending dividend announcement, and Distillers also moved in favour of holders. Staveley Coal and Iron were bought, partly on the recent news that the company's activities are to be extended by the erection of plant for the electrolytic manufacture of sodium chlorate. British Oxygen ordinary units remained active, partly on the interim dividend. Apart from the belief that conditions are running in favour of a further good increase in the company's profits, interest in the units is maintained at a high level by the possibility of some form of bonus next year. In 1936 the company will be celebrating its fiftieth anniversary, and a distribution of this sort may then be made. The following table shows this week's quotations compared with those of last week. Except where otherwise shown the shares are of £1 denomination.

Name.	Nov. 19.	Nov. 12.
Anglo-Iranian Oil Co., Ltd. Ord.	68/1½	67/6
,, 8% Cum. Pref.	37/-	36/6
,, 9% Cum. Pref.	38/3	37/9
Associated Dyers and Cleaners, Ltd. Ord.	2/6	2/6
,, 6½% Cum. Pref.	5/3¾	5/3¾
Associated Portland Cement Manufacturers, Ltd. Ord.	67/6	65/-
,, 6½% Cum. Pref.	27/6	26/6
Benzol & By-Products, Ltd. 6% Cum. Part Pref.	2/6	2/6
Berger (Lewis) & Sons, Ltd. Ord.	65/-	65/-
Bleachers' Association, Ltd. Ord.	8/1½	6/10½
,, 5½% Cum. Pref.	13/9	12/6
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	20/-	20/-
Boots Pure Drug Co., Ltd. Ord. (5/-)	49/3	48/3
Borax Consolidated, Ltd. Pfd. Ord. (£)	100/-	100/-
,, Defd. Ord.	17/9	17/9
,, 5½% Cum. Pref. (£10)	£11	£11
,, 4½% Deb. (1st Mort.) Red. (£100)	£109	£109
,, 4½% 2nd Mort. Deb. Red. (£100)	£102	£102
Bradford Dyers' Association, Ltd. Ord.	10/7½	10/-
,, 5% Cum. Pref.	14/4½	13/9
,, 4% 1st Mort. Perp. Deb. (£100)	£88	£88
British Celanese, Ltd. 7% 1st Cum. Pfd.	25/9	25/6
,, 7½% Part. 2nd Cum. Pref.	23/9	22/9
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	6/3	5/9
,, 4% 1st Mort. Deb. Red. (£100)	£94	£92
British Cyanides Co., Ltd. Ord. (2/-)	3/3	3/6
British Drug Houses, Ltd. Ord.	18/9	18/9
,, 5% Cum. Pref.	21/3	21/3
British Glues and Chemicals, Ltd. Ord. (4/-)	6/9	6/9
,, 8% Pref. (Cum. and Part.)	28/1½	28/1½
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	48/1½	46/10½
,, 5½% Cum. Pref.	26/3	26/3
,, 4½% First Mort. Deb. Red. (£100)	£106/10/-	£106/10/-
British Oxygen Co., Ltd. Ord.	113/10	112/6
,, 6¾% Cum. Pref.	32/6	32/6
British Portland Cement Manufacturers, Ltd. Ord.	92/6	87/6
,, 6% Cum. Pref.	30/6	29/6
Bryant & May, Ltd. Pref.	66/3	66/3
Burt, Boulton & Haywood, Ltd. Ord.	20/-	18/9
,, 7% Cum. Pref.	27/6	27/6
,, 6% 1st Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	108/9	108/9
,, 4% 1st Mort. Deb. Red. (£100)	£96/10/-	£96/10/-

Name.	Nov. 19.	Nov. 12.
Calico Printers' Association, Ltd. Ord.	10/7½	10/7½
,, 5% Pref. (Cum.)	16/3	15/11¼
Cellulose Acetate Silk Co., Ltd. Ord.	14/-	15/-
,, Deferred (1/-)	2/7½	2/7½
Consett Iron Co., Ltd. Ord.	11/9	11/3
,, 8% Pref.	28/9	28/9
,, 6% First Deb. stock, Red. (£100)	£107/10/-	£107/10/-
Cooper, McDougal & Robertson, Ltd. Ord.	36/3	32/6
,, 7% Cum. Pref.	28/9	28/9
Courtaulds, Ltd. Ord.	55/7½	53/9
,, 5% Cum.	26/3	24/4½
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.	25/-	25/-
,, Cum. 6% Pref.	28/9	28/9
,, 6½% Cum. Pref.	27/10½	29/4½
,, 7½% "A" Cum. Pref.	30/7½	30/-
Distillers Co., Ltd. Ord.	96/-	93/6
,, 6% Pref. Stock Cum.	31/6	31/6
Dorman Long & Co., Ltd. Ord.	22/6	21/6
,, Pref. Ord.	30/-	30/-
,, 6½% Non-Cum. 1st Pref.	23/6	23/3
,, 8% Non-Cum. 2nd Pref.	23/-	20/7½
,, 4% First Mort. Perp. Deb. (£100)	£102/10/-	£102/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£107	£105/10/-
English Velvet & Cord Dyers' Association, Ltd. Ord.	4/4½	4/4½
,, 5% Cum. Pref.	7/6	8/9
,, 4% First Mort. Deb. Red. (£100)	£72/10/-	£72/10/-
Fison, Packard & Prentice, Ltd. Ord.	41/10½	40/-
,, 7% Non-Cum. Pref.	31/3	31/3
,, 4½% Debs. (Reg.) Red. (£100)	£106	£106
Gas Light & Coke Co., Ord.	28/-	28/-
,, 3½% Maximum Stock (£100)	£89/10/-	£89/10/-
,, 4% Consolidated Pref. Stock (£100)	£106/10/-	£106/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£88/10/-	£88/10/-
,, 5% Deb. Stock Red. £100)	£116/10/-	£116/10/-
,, 4½% Red. Deb. Stock (1960-65) (£100)	£113/10/-	£113/10/-
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	14/4½	14/4½
,, 7% Prefd. Ord. (10/-)	13/9	13/9
,, 7% Cum. Pref.	28/9	28/9
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	28/9	28/9
Imperial Chemical Industries, Ltd. Ord.	37/6	36/6
,, Deferred (10/-)	9/1½	8/10½
,, 7% Cum. Pref.	33/6	33/9
Imperial Smelting Corporation, Ltd. Ord.	15/-	15/-
,, 6½% Pref. (Cum.)	24/3	24/3

Name.	Nov. 19.	Nov. 12.
International Nickel Co. of Canada, Ltd. Cum.	$38¼	$35½
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd. Ord.	117/6	118/9
Lawes Chemical Co., Ltd. Ord. (1/-)	6/3	6/3
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros., Ltd. 7% Cum. Pref.	32/3	32/-
,, 8% Cum. "A" Pref.	33/-	32/-
,, 20% Cum. Prefd. Ord.	77/6	77/6
,, 5% Cons. Deb. (£100)	£106	£106
,, 4% Cons. Deb. (£100)	£103	£103
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st Debs. (Reg.)	£40	£40
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	1/6¾	1/6¾
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	43/6	43/-
,, 1st Pref. 6½% Cum.	31/6	31/6
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£70	£70

Name.	Nov. 19.	Nov. 12.
Reckitt & Sons, Ltd. Ord.	115/7½	113/1½
,, 4½% Cum. 1st Pref.	25/-	25/-
Salt Union, Ltd. Ord.	40/-	40/-
,, Pref.	46/3	46/3
,, 4½ Deb. (£100)	£109/10/-	£109/10/-
South Metropolitan Gas Co. Ord. (£100)	£136/10/-	£136/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£107	£107
,, Perpetual 3% Deb. (£100)	£87/10/-	£87/10/-
,, 5% Red. Deb. 1950-60 (£100)	£116/10/-	£115/10/-
Staveley Coal and Iron Co., tLd. Ord.	48/1½	47/6
Stevenson & Howell, Ltd. 6½% Cum. Pref.	26/3	26/3
Triplex Safety Glass Co., Ltd. Ord. (10/-)	82/6	81/3
Unilever, Ltd. Ord.	31/10½	32/6
,, 7% Cum. Pref.	29/3	28/9
United Glass Bottle Manufacturers, Ltd. Ord.	43/6	43/-
,, 7½% Cum. Pref.	33/-	33/-
United Molasses Co., Ltd. Ord. (6/8)	21/3	20/-
,, 6% Cum. Pref.	25/-	25/-
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	8/6	8/3
,, 7% Cum. Pref.	24/4½	25/-
,, 6% Deb. Red. (£100)	£102/10/-	£102

From Week to Week

A REDUCTION OF THE CAPITAL of British Bemberg, Ltd., Doncaster, from £1,250,000 to £450,000 was confirmed by Mr. Justice Bennett in the Chancery Division on November 11.

L. LAMBERT & CO., LTD., chemical manufacturers, etc., 4 Percy Street, S.W.1, have increased their nominal capital by the addition of £24,000 in £1 ordinary shares beyond the registered capital of £6,000.

THE DUKE AND DUCHESS OF GLOUCESTER visited the steel works of Stewarts and Lloyds, Ltd., at Corby, Northamptonshire, on Tuesday and watched the various stages of Bessemer steel manufacture.

ALLIED COLLOIDS (BRADFORD), LTD., manufacturers of and dealers in chemicals, gases, drugs, etc., of 257/260 Swan Arcade, Bradford, have increased their nomical capital by the addition of £4,000 beyond the registered capital of £1,000. The additional capital is divided into 4,000 6 per cent. cumulative preference shares of £1 each.

A FOURTEEN-YEAR-OLD SCHOOLBOY'S EXPERIMENTS with chemicals resulted in an explosion and a fire which did considerable damage at the house of Mr. S. Neilsen, shipping purveyor, Hymer's Avenue, Hull. When investigations were made it was found that Mr. Neilsen's son had left a mixture of chemicals in a drawer and it had exploded.

THE INSTITUTION OF CHEMICAL ENGINEERS announces that application forms and particulars of the associate membership examination for 1936, together with copies of a memorandum on "The Training of a Chemical Engineer," may be obtained from the hon. registrar of the Institution of Abbey House, Westminster, S.W.1. The application forms are returnable on December 20.

THIRTY OIL PROSPECTING LICENCES, covering 5,438 square miles of England, have been issued by the Board of Trade, announces the Mines Department. The licences have been granted to the D'Arcy Exploration Co., the development subsidiary of the Anglo-American Oil Co. The districts covered by the licences are in Surrey, Sussex, Hampshire, Dorset, Wiltshire, Lincolnshire, Nottinghamshire, Leicestershire, Rutland, Cambridgeshire and Norfolk. Applications for licences for more than 20 other areas are under examination. A prospecting licence in Britain remains in force for three years, and may be renewed for two furnther yearly periods. It costs £20. The maximum area for which a prospecting licence can be granted is 200 square miles and the minimum area eight square miles.

A PROPOSED INCREASE OF THE CAPITAL of Thos. Firth and John Brown, Ltd., will come before an extraordinary meeting of shareholders on November 25. The resolution provides for an increase from the existing capital of £2,450,000 to £2,550,000 by the creation of 100,000 "A" ordinary shares of £1 each. John Brown and Co. are the holders of the whole of the 450,000 "B" ordinary shares of £1 each, and they have agreed to the proposal. The additional "A" ordinary shares will rank pari passu in all respects with the exising 1,000,000 "A" ordinary shares, save that the additional shares will not carry the right to participate in any dividend in respect of the period to January 1, 1936. John Brown and Co., Ltd., will continue to hold their shares in Thos. Firth and John Brown, Ltd., but they will now hold all but £210,000 of this capital.

THE "PROCEEDINGS OF THE INDIAN ACADEMY OF SCIENCES" for October have just been published. As is usual, the volume contains a diversity of material ranging from pure mathematics to the life story of a plant.

THE DEMAND FOR BLUE AND BLACK SUEDE LEATHERS continues, but British producers are experiencing difficulty in securing a blue fast to rubbing. Most firms are developing the black on the leather by diazotisation.

IN CONSEQUENCE of the closing down of the Leeds Steel Works, the plant has been acquired for dismantling by Holinter, Ltd., whose London office is at Wheatsheaf House, 4 Carmelite Street, E.C.4. The company has for disposal a considerable number of cylindrical tanks suitable for chemical works.

THE NEW PREMISES of the Askim Rubber Goods factory, which was almost completely destroyed by fire two years ago, are now fully employed. On some 26,000 sq. metres of floor space 1,200 workers are now busy with the daily production of 100,000 pairs of rubber-soled slippers and canvas shoes, of 10,000 goloshes, 300 bicycle tyres, and 100 motor-car tyres. The company's export business is also satisfactory.

WE HAVE RECEIVED two more leaflets from Typke and King, Ltd., on vulcanisation accelerators for the rubber industry. A long article was published in THE CHEMICAL AGE on this subject on April 23, 1932. These notes show how Z.P.D. (or zinc pentamethylene dithiocarbamate) can be used to give non-scorching stocks curing at moderate temperatures at almost any desired speed. Such stocks possess high tensile strength and modulus, and age well.

THE IMPORT DUTIES ADVISORY COMMITTEE gives notice of applications for increases in the import duties on rice, millet and buckwheat starches, and cornflour, custard powder and laundry materials containing such starches. Any representations which interested parties may desire to make in regard to these applications, should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than December 5.

THE FIRST NUMBER of the Journal of the Institution of Civil Engineers appeared on November 15. The first volume of transactions was published in 1836 by John Weale, whilst for the last ninety-eight years the "Minutes of Proceedings" have remained unchanged in form down to the present time and constitute a series of 240 volumes, of which the last two volumes are in the press. The Journal is the modern development of the steps that have been taken, from shortly after the time Telford became the first president in 1820, to disseminate knowledge necessary in civil engineering. Portraits of the first president, Thomas Telford (1820-1834), and of the president for Session 1935-36, Mr. John D. Watson, appear in the first number, which opens with a foreword by Mr. Watson and an account of the origin and progress of the Institution. Then follow the presidential address for this session, details of the work of the research committee, four papers published by the Institution and a lecture on "Surveying from Air Photographs," in addition to reports of the work of the local associations. The journal will appear in December, January, February, March, April, June, October and November, making eight during the year, of which six will appear during the session and two in the recess.

THE ANNUAL MEETING OF THE BRITISH CYANIDES CO., LTD., was held on Wednesday. Mr. Kenneth M. Chance (chairman and managing director) said that the gross profit for the twelve months under review—£74,227—was rather more than the actual gross profit for the previous fifteen months. For the same comparative period of twelve months, the year under review showed an increase of £15,150. The net profit was £26,674, which, after deducting the preference share dividend, permitted the directors to recommend a dividend for the twelve months of 8 per cent., carrying forward £2,796, or about £500 more than last year. As to the consolidated balance-sheet, one of the most interesting items was that showing the liquid assets to exceed current liabilities by no less than £138,300. The consolidated statement of profits showed that £15,133 had been written off out of profits for depreciation before arriving at the net profits for the year.

PLANS WERE SUBMITTED by Nobels Explosives Co., Ltd., on Tuesday, at Irvine Dean of Guild Court, of alterations at the old Kyle Chemical Co.'s works, Gailes Road, Irvine, for the purpose of a factory for the manufacture of fireworks. Mr. Adam Wilson and Mr. Bramwell appeared on behalf of Nobels, Ltd. The plans were passed. Mr. Wilson, replying to questions by the Dean of Guild as to the type of fireworks to be manufactured in the proposed factory, said that would depend on what the Government wished to buy. The first order to be carried out would be for signal grenades for the Navy, and later perhaps an order for Very lights, etc. There would not be any high explosives manufactured in this class of work. Dean of Guild Brady said they were anxious to know the nature of the work and how many would be employed. Replying, Mr. Wilson said it was very difficult to say as this was only a beginning and was really an overflow from one of their other factories. Later the factory would probably be working continuously, but to begin with girls and men would be employed on a day shift.

Prices of Chemical Products

Current Market Conditions

WITH the exception of the products mentioned below, the prices of chemicals remain as reported in THE CHEMICAL AGE last week (pages 458-459).

LONDON.—Prices still remain steady with the exception of technical acetic acid 80%, which has been reduced by £3 per ton. Good steady trade is being maintained generally. In the coal tar products section pitch is quoted at about 35s. to 37s. 6d. per ton f.o.b. East Coast port, for this season's delivery.

MANCHESTER.—Trading conditions on the Manchester chemical market during the past week have been more normal after the unsettlement of the previous week. Sentiment is fairly cheerful, on the whole, allowing for the international political uncertainties, and there is a disposition to look for a steady improvement in trade over the next few months. Meanwhile, in several directions this week traders have reported a better demand for the leading lines of heavy products, and there is a tendency for specifications to cover increased quantities, more especially in respect of the textile dyeing and finishing branches, operations in which are more active. Prices are firm in virtually all departments. In the by-products section this week, local firms report continued activity and general firmness is a feature, further price advances having been registered in several directions. The statistical position of the tar products market is distinctly stronger than it was a few months ago.

SCOTLAND.—There has been a steady demand for chemicals for home trade during the week, though export inquiries have been rather limited. Main interest is centred in contracts for requirements over 1936. Prices generally continue very firm at about previous figures with only slight changes to report.

General Chemicals

ACID, ACETIC.—Tech. 80%, £38 5s. to £40 5s.; pure 80%, £39 5s.; tech., 40%, £20 5s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. LONDON: Tech., 80%, £35 5s. to £37 5s.; pure, 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech., 80%, £38 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £49 to £55 ex store.

ARSENIC.—LONDON: £15 per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £22, ex store.

LEAD, ACETATE.—LONDON: White, £36 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36; brown, £34 10s.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £38.

SANDALWOOD OIL, Australian, B.P. and French Codex 92/95%, 15s. 3d. per lb.

Coal Tar Products

ACID CRESYLIC.—90/100%, 1s. 11d. to 2s. 6d. per gal., according to specification; pale 98%, 1s. 7d. to 1s. 8d.; dark, 1s. 4d. to 1s. 5d. LONDON: 98/100%, 1s. 4d.; dark, 95/97%, 1s. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s. 1d.; high boiling acid, 2s. 6d. to 3s.

CREOSOTE.—B.S.I. Specification standard, 5¾d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4¼d. f.o.r. North; 5d. London. MANCHESTER: 5½d. SCOTLAND: Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4¼d.; heavy, 4¼d. to 4½d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £10 10s. per ton; purified crystals, £13 10s. per ton in 2-cwt. bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH SILK DYEING CO., LTD., London, E.C. (M., 23/11/35.) Nov. 6, disposition supplemental to £100,000 debs., to Weidmann Holding Aktiengeselschaft, Zug. Switzerland; charged on land and buildings at Bonhill (Dumbarton). *£100,000. Dec. 25, 1934.

Satisfactions

DEVONSHIRE BARYTA CO., LTD., Christow. (M.S., 23/11/35.) Satisfaction reg. Nov. 13, £5,000, reg. Feb. 6, 1931.

MALEHURST BARYTES CO., LTD., Minsterley. (M.S., 23/11/35.) Satisfaction reg. Nov. 12, of deb. and further charge reg. July 30 and October 19, 1932, to extent of £4,000.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

MATTHEWS PRODUCTS, LTD., 8 Breakspears Road, S.E.4, drysalters. (C.C., 23/11/35.) £12 13s. 6d. Oct. 16.

MATTHEWS PRODUCTS, LTD., 8 Breakspears Road, S.E.4, chemical mfrs. (C.C., 23/11/35.) £13 11s. 0d. Oct. 4.

Company News

British Tar Products.—A final dividend of 3¾ per cent. and a bonus of 5 per cent., less tax, is announced on the ordinary and preferred ordinary shares, making 10 per cent., and a bonus of 5 per cent. for the year, payable on November 29.

Weardale Lead Co.—The profit for the year to September 30 last, including income from investments, amounted to £6,550; to tax reserve is placed £750; written off property, plant and machinery account, £3,265; dividend, 40s., less tax (against nil), leaving to be carried forward, £2,501, against £1,503 brought in.

Tate and Lyle.—A final dividend of 14 per cent. is announced. Together with the interim of 6 per cent. already paid, this makes a total of 18.2857 per cent., subject to deduction of tax, for the year on the ordinary capital increased to £4,760,000 by a 40 per cent. capital bonus distributed last May. The directors have decided to place £310,000 to general reserve, and the carry-forward is increased from £43,341 to £56,233.

"Shell" Transport and Trading Co.—The directors announce that they have decided to defer for the present their decision as

to an interim dividend on the £24,121,361 ordinary capital. No interim payment was made last year, but 12½ per cent., tax free, was distributed at the end of the year, against 7½ per cent. in 1933. The last interim dividend was in 1930, when 10 per cent. was paid, followed by a final of 7½ per cent.

Joseph Nathan & Co.—In the year to September 30 last, it is reported that profits, after providing for contingencies and subject to audit, rose by £18,379, to £73,943. At the annual meeting, to be held in March, the directors will recommend the payment of two years' dividend on the 8 per cent. preferred ordinary shares. This will bring dividends on these shares up to September 30, 1934. Warrants for the half-yearly dividend on the 7 per cent. preference shares will be posted on December 31.

British Cotton and Wool Dyers' Association.—For the half-year to September 30 last, the profit amounted to £53,358, compared with £42,904 in 1934. After debenture interest and making a further transfer of £12,500 to depreciation, the net revenue is up from £17,224 to £27,812. The credit balance on profit and loss is increased from £45,218 to £73,031. For the year to March 31 last, net revenue amounted to £60,723. Ordinary dividends of 5 per cent. have been paid during the past three years.

New G. and S. Processes Syndicate.—The report for the period ended September 30 shows profit and loss account balance brought in £1,984, add expenses for 18 months to date £1,302, bad debt £44, and losses on sale of stock, plant, etc., £787, making £4,117. The issued capital is now £21,400 in 428,000 shares of 1s. each fully paid. Processes, goodwill, etc., appear in balance-sheet at £18,422, preliminary expenses at £198, and cash £1.

British Oxygen Co.—An interim dividend is announced on the £1,933,302 issued ordinary stock and shares of 7 per cent., or 1s. 4.8d. per £1 nominal amount of such stock and shares, less tax, on account of the year ending December 31, 1935. Last year's interim dividend was 4 per cent., followed by a final distribution of 11 per cent., making a total of 15 per cent. on the ordinary capital of £1,657,116. A total of 9 per cent. was paid for the previous year on the £1,519,091 then issued.

United Drug, Inc.—The report for the quarter to September 30 shows operating profit $68,190, and net profit, including $70,111 profit from sale of investments, of $138,331, equal to 10c. a share on 1,400,560 shares (par $5) of capital stock, against $131,658, equal to 9c., in the preceding quarter; in the September quarter of the previous year the operating loss was $46,875, and the net profit, including $538,912 profit from sale of investments, was $492,037, equal to 35c. a share).

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Spain.—An agent established in Barcelona wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of transparent wrapping paper, pharmaceutical preparations and fine chemicals. (Ref. No. 460.)

Inventions in the Chemical Industry

Patent Specifications and Applications

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications open to Public Inspection

Process and apparatus for melting and treating organic substances.—Beck, Koller and Co., Inc. May 5, 1934. 11368/35.

Mixed ester derivatives of glycol.—Carbide and Carbon Chemicals Corporation. May 8, 1934. 12638/35.

Processes and apparatus for splitting hydrocarbons.—Gutehoffnungshütte Oberhausen A.-G. May 5, 1934. 13205/35.

Alginates, manufacture.—A. H. Gruart. May 5, 1934. 13268/35.

Vat dyestuffs containing two-thiazole rings, manufacture.—I. G. Farbenindustrie. May 9, 1934. 13294/35.

Non-decyl oxygenated compounds, production.—Carbide and Carbon Chemicals Corporation. May 9, 1934. 13322/35.

Alcohol sulphation process.—Carbide and Carbon Chemicals Corporation. May 9, 1934. 13323/35.

Recovery of tin, more particularly from scrap metal containing same, process.—T. Goldschmidt A.-G. May 7, 1934. 13467/35.

Producing galvanic coatings on aluminium and its alloys, process.—Siemens and Halske A.-G. May 7, 1934. 13498/35.

Hydro-silicate bound moulded bodies, process for manufacture.—K. I. A. Eklund. May 8, 1934. 13551/35.

Cellulose esters and products of same, process for production. Wolff and Co. Komm Ges. May 9, 1934. 13724/35.

Readily-emulsifiable mineral oil compositions.—International Hydrogenation Patents Co., Ltd. May 11, 1934. 13884/35.

Esters of 2-butyloctanol.—Carbide and Carbon Chemicals Corporation. May 11, 1934. 13885/35.

Specifications Accepted with Date of Application

Sodium arsenite and compositions for insecticidal or fungicidal purposes containing the same, production.—M. Fitzgibbon and Lunevale Products, Ltd. Nov. 15, 1934. 438,022.

Azo dyestuffs, manufacture.—Deutsche Hydrierwerke A.-G. Feb. 7, 1933. 438,025.

Alloys containing thorium.—W. Guertler. April 28, 1933. 437,739.

Alloys containing iron and chromium, treatment.—K. H. S. Löfquist. May 1, 1933. 437,741.

Azo dyestuffs, manufacture and production.—Coutts and Co., and F. Johnson (I. G. Farbenindustrie). May 4, 1934. 437,951.

Acridine derivatives, process for manufacture.—I. G. Farbenindustrie, F. Mietzsch and H. Mauss. May 4, 1934. (Addition to 363,392.) 437,953.

Treating native starches with oxidising agents, method.—W. Seck. May 4, 1933. 437,890.

Water-insoluble azo dyestuffs, process for manufacture.—I. G. Farbenindustrie. May 10, 1933. 438,046.

Dyestuffs on cellulosic fibres, process for manufacture.—I. G. Farbenindustrie. May 10, 1933. 438,047.

Polyvinyl esters, manufacture.—I. G. Farbenindustrie. May 12, 1933. 438,050.

Refining crude fats and fatty oils, process.—E. W. Fawcett and Imperial Chemical Industries, Ltd. May 11, 1934. 438,056.

Azo dyestuffs, manufacture.—M. J. G. Bader. May 20, 1933. 437,824.

Applications for Patents

(November 7 to 13 inclusive.)

Calcium hypochlorite pellet.—W. S. Bachman. 30939.

Device on cyclone apparatus for separating solid particles from gases.—T. C. Bieth. (Sweden, May 16.) 31135.

Isomerising dehydroandrosterone, etc., process.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 30932.

Artificial resins, manufacture.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 31297.

Cellulose acetate materials, manufacture.—British Celanese, Ltd., H. Dreyfus, F. B. Hill and R. W. Moncrieff. (Feb. 2, '34.) 30944, 30946.

Moulded articles from cellulosic material and cement, manufacture.—A. Boys. 30920.

Acetylene-gas generating apparatus.—Carbic, Ltd., and H. Them. 30917.

Dyestuffs containing metal, manufacture.—A. Carpmael (I. G. Farbenindustrie). 31335.

Tanning materials, manufacture.—A. Carpmael (I. G. Farbenindustrie). 31336.

Tris- and tetrakis-azo dyestuffs, manufacture.—A. Carpmael (I. G. Farbenindustrie). 31453.

Nitrocellulose compositions, manufacture.—Celluloid Corporation. (United States, Nov. 9, '34.) 31202.

2.4-dinitro-3 : 6-dihalogenanilines, manufacture.—Chemical Works, formerly Sandoz. (Switzerland, Nov. 24, '34.) 31295.

Methacrylic acid amide, manufacture.—F. B. Dehn (Röhm and Haas A.-G.). 31150.

Barbituric acid compounds, production.—M. Dobroschke, Taeschner Chemisch-Pharmazeutische Fabrik and W. Ursum. 31458.

Gelatine, etc., compositions.—E. I. du Pont de Nemours and Co. (United States, Nov. 8, '34.) 30840.

Esters of acids of phorphorus, manufacture.—E. I. du Pont de Nemours and Co. (United States, Nov. 10, '34.) 30896.

Cellulose acetate compositions.—E. I. du Pont de Nemours and Co. (United States, Nov. 16, '34.) 31197.

Purified glycyrrhizine, preparation.—Etablissements Sareb Soc. Anon. (Belgium, Nov. 10, '34.) 31151.

Forthcoming Events

LONDON

Nov. 25.—Institution of the Rubber Industry (London Section). "Some Aspects of Propaganda in the Rubber Industry." James Fairbairn. 6.30 p.m. 12 St. James's Square, London, S.W.1.

Nov. 27.—Institute of Metals (London Section). Supper-Dance. 7.30 p.m. Thames House, Millbank, London.

BRISTOL

Nov. 29.—Institute of Brewing. Papers on the Institute's Research Work, by G. T. Cook, H. M. Lancaster, and W. J. Watkins. 5.30 p.m. Dinner. 7.30 p.m. Royal Hotel, Bristol.

GLASGOW

Nov. 29.—Society of Dyers and Colourists (Scottish Section). "Chemical Reactions under Pressure." Professor W. M. Cumming. 7.30 p.m. St. Enoch Hotel, Glasgow.

HULL

Nov. 29.—Hull Chemical and Engineering Society. Dinner and Dance. Powolny's, King Edward Street, Hull.

LEEDS

Nov. 25.—Institute of Chemistry (Leeds Area Section). Annual general meeting. "The Technical Utilisation of Acetylene and Acetaldehyde." F. A. Mason. Leeds.

LEICESTER

Nov. 27.—Leicester Literary and Philosophical Society (Chemistry Section). "Recent Developments in Sewage Disposal." J. A. Christian. 7.30 p.m. College of Technology, Leicester.

LIVERPOOL

Nov. 30.—British Association of Chemists. Annual meeting. 3 p.m. Annual dinner. 7 p.m. Adelphi Hotel, Liverpool.

MANCHESTER

Nov. 26.—The Chemical Society. Joint meeting with the University of Manchester Chemical Society. "The Calcification of Animal Tissues." Professor R. Robinson. 4.30 p.m. University, Manchester.

Nov. 29.—Manchester Literary and Philosophical Society (Chemical Section). "Chemical Aspects of Pest Control." F. L. Sharp. 36 George Street, Manchester.

NEWCASTLE

Nov. 29.—Institute of Chemistry (Newcastle-on-Tyne Section). Charter Jubilee Dinner. Royal Station Hotel, Newcastle.

SHEFFIELD

Nov. 29.—The Chemical Society. "Some Modern Views on Chemical Reaction Velocity." Professor M. Polanyi. 5.30 p.m. University, Sheffield.

Official Publications Received

Survey of the River Tees. Part II—The Estuary—Chemical and Biological. London: H.M. Stationery Office. Pp. 171. 9s.

Bulletin of the Imperial Institute. Vol. XXXIII. No. 3. 1935. London: John Murray. Pp. 150. 3s. 6d.

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THE INSTITUTION OF CHEMICAL ENGINEERS EXAMINATION, 1936.

Application forms (returnable 20th December, 1935) and particulars of the Associate-Membership Examination for 1936, together with the Memorandum on "The Training of a Chemical Engineer," may be obtained from the Hon. Registrar, Institution of Chemical Engineers, Abbey House, Westminster, London, S.W.1.

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